THE

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ELECTRICAL REVIEW.

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INDUSTRIAL RESEARCH.

"Where ignorance is profitable 'tis folly to be wise."
Pro tem. Maxims.

IN man's struggle with Nature it is well that his vanguard should be amply provided with scouts to report the features and character of the scattered outposts they establish in the vast territory of the unknown.

It is an established dogma of scientific belief that knowledge should be pursued for its own sake and that the quest for truth should be untrammelled by any specifically utilitarian aim. But just as an army moves upon its belly so does human progress depend upon industry as its commissariat, and it is becoming evident to some thinkers that the time has now come when the "scouting" can no longer remain sporadic but must be organised, and in certain domains must be definitely industrial in its aim.

As a nation of shopkeepers we are doubtless alive to the importance of these issues, for our State at the present time devotes no less than £180,000 per annum to University education in England and Wales, and if we include such Institutions as the National Physical Laboratory, and the grant of £4,000 to the Royal Society, we may say that our country is expending about £200,000 per annum on the highest education and the promotion of research. This total sum, Principal Griffiths assures us in his recent address to the British Association, is slightly in excess of that devoted to *one* of the Universities of Germany.

In his recent Presidential address to the American Chemical Society, Mr. A. D. Little dealt with the question of Industrial Research in America, and it may not be without interest briefly to review the steps taken in the United States for winning new knowledge to aid their industries in keeping abreast of our own in the race for commercial supremacy.

First, as to some examples of individual achievements:—With their agricultural machinery, the Americans have reduced the labour cost of seven crops by £116,000,000, as measured by the methods of only 50 years ago.

Aluminium discovered in Germany by Wöhler in 1828 cost £18 per lb. in 1855; in 1911 the Pittsburg Reduction Co. produced 40 million pounds of the metal at 11d. per lb.

The development of the motor-car, and especially of the low-priced American car, is a thing of yesterday; to-day a single manufacturer turns out two cars a minute, while another is expanding his output to 500 cars a day.

The invention by Gayley of the dry-air blast in the manufacture of iron involves a saving to the American people of from three to five millions sterling per annum.

The Americans appear to be under the impression that efficiency of production is a sounder basis for prosperity than mere volume of produce, however great, and they have instituted long-continued and highly-organised researches with this end in view.

There are in the States at least 50 notable laboratories engaged in industrial research. The expenditure of several

of these laboratories is over £60,000 each per annum. The United States Steel Corporation has not hesitated to spend £60,000 upon a single research, and the annual expenses of a dozen or more of the laboratories referred to probably exceed £20,000 for each laboratory.

The State participates directly in the work of industrial research; the Department of Agriculture includes within its organisation 10 scientific bureaus, and its printing bill for the past year was £10,000. The research work of this department receives local application through the agency of 64 State experimental stations, the present income of which exceeds £600,000 per annum.

The Bureau of Fisheries devotes £8,000 to a single study, and the Geological Survey gives £20,000 to investigating the mineral resources of Alaska.

The Bureau of Mines conducts fundamental inquiries and investigations in the mining and mineral industries; its appropriation for the current year is £132,000, of which £70,000 is to be devoted to technical research.

The Bureau of Standards of the Department of Commerce devotes about £140,000 per annum to the testing of standards and the investigation of the properties of materials.

Most of the American universities are actively engaged in industrial research, and Kansas and Pittsburg have recently established Industrial Research Fellowsh ps, which are supported by the special interests directly concerned.

To return to our own position—are we satisfied with it? Are we attaching sufficient importance to this matter of industrial research, and are we approaching it in a corporate and national spirit?

Michael Sadler has shown us that modern Syndicalism springs from several sources besides mere discontent with Parliamentary institutions. It is part of a great return of the modern mind to the mediæval model. In every calling we see signs of a new professional consciousness. What the Middle Ages (very imperfectly and with ultimate failure) tried to accomplish through the Guild system, the modern mind hopes to attain through a stronger sense of professional solidarity and corporate life.

The electrical industry of to-day has its own guilds, and the I.E.E., at any rate, has shown that it is alive to the need of organised industrial research; and it is up to all of us to lend it our interest and support and to strengthen its hands in this corporate endeavour to win new knowledge for the electrical industry. But it ought not to be left entirely to such organisations to promote research for the benefit of the nation; that this is being realised by Parliament is evidenced by the formation of the Development Fund, part of which ought certainly to be allocated to industrial research. Has our Institution applied for a grant from the Fund? If not, why does it not do so?

Copartnery or Co-partnership?

A few years ago, with a great flourish of trumpets and beating of drums, the Furness scheme of "Copartnery," as its author styled it, was propounded. After considerable discussion, and against the advice of Trade Union officials, it was given a 12 months' trial, at the end of which it was abandoned, although it was claimed to have worked very well, and to have been profitable alike to masters and men. Now, however, we are told that the Furness scheme was not copartnership at all!

In the December number of *Co-partnership* the scheme is referred to as follows:—

So often is the failure of the Furness scheme referred to in discussions on industrial matters that we cannot too frequently point out that the method so greatly heralded from Hartlepool a few years ago was never regarded in the town or by advocates of our movement as having anything of a copartnership hue. And we would advise readers to carefully follow the report of the Labour Copartnership Association meetings at Leeds, and to observe the speech of Mr. T. C. Taylor, M.P. As an employer who practises what he preaches, he was able to declare that the Furness plan was not only innocent of all suspicion of copartnership, but could not even claim to be profit-sharing. It simply made provision for the purchase of shares by contributions from the men's wages—with no addition from the employer. To regard it as copartnership is erroneous; to describe it as a profit-sharing failure is unfair to the movement with which it had no association.

On turning up the report of Mr. T. C. Taylor's speech, we find the following expression:—

"With reference to the Furness scheme, he would say that it was neither copartnership nor profit-sharing in the least degree. According to that, out of the workmen's wages something was to be stopped to pay for a share upon which they were to have dividend just like any ordinary shareholder. They were to have interests in the profits only as capitalists, and to pay for their own shares. Was that profit-sharing? Not a bit of it."

Surely, if the workmen were to have an interest in the profits as capitalists, they *shared* in the profits with the other capitalists. At the time the Furness scheme was formulated we, in company with a large number of journals, technical and otherwise, considered it to be a *bona fide* attempt to start a profit-sharing or copartnership arrangement. Was there, after all, a subtle difference between "copartnership" and "copartnery," and is it not time we had a working definition of "copartnership"?

Copper.

The position of copper has visibly deteriorated, and that to a distinct extent, and in place of the confident feeling, which was so apparent a few weeks ago, the market has settled down into a fit of gloom and pessimism in the strongest contrast with what had been the current course of sentiment for several months. The actual position of the metal has worsened largely because of the increase in production which is in progress in many of the chief centres of output, which increase synchronises with a slackening of trade all over the world. It is a singular fact that while the leading American producers seem able enough to manage the market when it has everything in its favour, they are all at sea when things turn in the opposite direction. With any little adverse feature developing, they invariably adopt an attitude which has a very unfortunate effect upon the market in the long run. This year, again, a position has arisen in which the leading interests could have sold all their accumulations at pounds above the rates current to-day, if only they had been reasonable, but instead, they chose the niggardly and cheeseparing policy of lowering their prices by shillings instead of by pounds, and the result was that whereas they could have sold heavily at £72, or at any rate at £71, they are now looking for buyers at pounds below this level, and are sending copper to Europe on consignment to find a market. This is a pretty pass after the wholly exceptional strength of the market only a few weeks ago.

Of course, much of the excellence of the position arose from the development of unforeseen circumstances, such as strikes in producing centres and at refineries, and to this extent a return to more normal conditions as regards prices was inevitable sooner or later, but what upsets people is the way in which the leading interests fail to grasp what are regarded as trade essentials. At times, indeed, they seem to be quite out of touch with the market. This is, of course, all to the good for consumers, who to-day are undoubtedly paying a good deal less for copper than they would have been doing had the course of events been directed by a knowing hand, but the bulls of copper who got badly left

are not able to look upon the records of the last few weeks with anything approaching sangfroid at present.

There is considerable interference now with consumption in the United States by serious strikes which have broken out, but it is curious how little is heard of these impediments. When a mine shuts down, or a smelter has to blow out for flue cleaning, all the world and his wife are advised of the news, but the facts that one of the leading copper consumers has 12,000 men out on strike, and that other consumers are also having trouble with their employés, have hardly been considered as of any account. This is a feather showing the direction of the wind. The outlook is certainly not for permanently higher prices yet awhile, though possibly there may be a reaction.

The anxiously-awaited American returns have now appeared, and the market has taken them very philosophically. As a matter of fact they were about as the majority of people expected. The best feature was the absence of increase in the production, which, indeed, was slightly smaller than during October, while the total deliveries were about 8,000 tons less. This was accounted for entirely, however, by the lessened home trade takings, these showing a falling-off of about that amount, from 30,434 tons to 21,722 tons, arising in the greater measure from strikes at the works of the largest United States consumers, causing the postponement of deliveries. The export movement was large, at a little over 31,000 tons, while there was an increase in the stocks at American refineries during November of nearly 7,000 tons. The returns were, on the whole, a trifle better than had been expected, the most favourable item, as stated, being the production returns.

The Chief Engineer's Department of the L.C.C.

The fact that the position of Deputy Chief Engineer is vacant has given the London County Council a good opportunity to consider the organisation of the higher posts in the Chief Engineer's Department. Acting on the advice of the Establishment Committee, a number of changes have been made.

The office of deputy chief engineer has been abolished, and the old practice reverted to by which the officer in charge of one of the branches of the department is designated chief assistant engineer. This gentleman under the new plan will receive a salary of £800 per year, rising by increments of £50 to £1,000 a year.

The staff of the department is to be divided into six principal branches :—(*a*) Parliamentary and improvements; (*b*) bridges and tunnels; (*c*) mechanical; (*d*) tramways; (*e*) electrical; (*f*) main drainage. This last department is at present divided into two parts, one for the system north of the Thames, and the other for the system south of the river. At present the principal post in each part is held by an engineer; one of these receives £800 a year, and the other £750. It is proposed eventually to appoint an assistant engineer in charge of both divisions, add the designing of new works to his duties, and pay him a salary commencing at £700, and rising by annual increments of £50 to £1,000 a year. Immediate effect cannot be given to this arrangement, and for the time being there will be two assistant engineers.

For two of the remaining branches, the salary of the assistant engineer-in-charge will be £600 a year, rising by annual increments of £50 to £800, and for the other two £500 a year, rising by annual increments of £50 to £700 a year. The second officer in each section except the main drainage branch, an extra assistant in the tramways branch, and two additional assistants in the main drainage branch, are to receive salaries commencing at £400 per year, and rising by either £50 or £25 per annum to maxima varying from £450 to £600 per year.

In the main drainage branch there will be two principal assistants, one for the north and the other for the south of the river. These will each commence at £500 a year, and rise by annual increments of £50 to £700. The chief clerk of the department will receive £400 a year, rising by six annual increments of £25 to £550.

In addition to the foregoing, there will also be fifteen senior assistants, each with a salary of £300 a year, rising by annual increments of £25, 11 to £400, and four to £350 a year; 35 first-class assistants, 18 second-class; seven minor establishment assistants, and 10 non-classified assistants at weekly wages varying from 42s. to 63s. per week.

It appears from the above that an attempt has been made to organise the department in such a way as to secure thorough efficiency. We have given the detailed proposals, as we are sure they will prove of interest in informing our readers as to the annual values of positions which for importance and prestige may be looked upon as prizes worth aiming for and winning.

When the scheme is completed the extra cost to the Council will be about £280 a year more than at present, including the salary attached to the position of deputy chief engineer.

London's Electricity Supply.

The comparison instituted between London, Berlin and Chicago with regard to their electricity supply by Prof. G. Klingenberg, at the meeting of the Institution of Electrical Engineers in London last week, while interesting in itself, gains added interest from the fact that it represents the views of an impartial and disinterested observer, who is in a position to take a bird's-eye view of the great problem of supplying London with electrical energy on the soundest lines. That this will shortly become the question of the hour in electrical circles is certain; the "appointed day" is approaching when, unless new arrangements are made, the London County Council will have to tackle the purchase of the undertakings which at present supply the bulk of the electricity consumed in the Metropolis, and to consider how best to deal with a position of extreme difficulty and complexity. It is not likely that the matter will be allowed to drift to its climax as in the case of the transfer of the telephone service to the State; the public interests involved are far too important to be dealt with in a manner so clumsy and unstatesmanlike. Long before 1931 arrangements must be made to ensure that capital shall continue to flow into the undertakings, and that their plant and equipment shall be kept up to the highest standard of efficiency; and to this end it is essential that the situation be analysed and studied in all its bearings at no distant date. Already signs and portents of the coming change have begun to show themselves. The County Council has taken practical steps to reconnoitre the field, the County of London Co. is seeking powers to purchase land and to effect combinations which are clearly not unconnected with the matter, and various engineers, including Dr. Klingenberg, are turning their attention to the subject.

The paper is, therefore, well timed, and will do good service by showing how far the existing chaos—due to political influences, and not to engineering incapacity, as Dr. Ferranti pointed out in the discussion—has kept London behind other great capitals by indicating the directions in which improvement may be sought, and by affording comparisons which will provide ideals at which to aim.

Whether Dr. Klingenberg's suggestions for the future conduct of the supply are applicable to the special conditions which obtain in this land of vested interests and statutory restrictions cannot be discussed here, but it was interesting to observe in the discussion at the Institution how widely the speakers differed in their points of view. Mr. Snell advocated a curious combination of the theoretically desirable with the actually existing in the form of bulk supply from outside and distribution by the present authorities; Dr. Ferranti emphasised the importance of cheapening the supply of electricity, and the dire results of political meddling with engineering problems; Mr. Seabrook claimed the author as a supporter of his views on tariffs, and Mr. Tapper differed from them both. It is evident that the address affords scope for discussion, and we trust that it will be productive of valuable results.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Concluded from page* 901.)

The Lodge.—The machine made by Messrs. Lodge Bros. and Co. is of the permanent-magnet type, and is designed to give an output of 120 watts at 6 volts. The regulation of the current output is automatically controlled by the armature re-action, which occurs at high speeds. In addition to an electro-magnetic cut out, fitted on the swichboard, a free wheel clutch is mounted on the armature spindle to prevent the battery discharging through the dynamo when the latter is stopped or only running slowly.

The T. and M.—The feature of the dynamo made by Messrs. Trier and Martin, Ltd., of Camberwell, is the means adopted for maintaining a steady output. The machine is of the two-pole shunt-wound type with a special inter-connection arrangement of the brushes. Four brushes—two main and two auxiliary—are employed, these being equally disposed round the commutator; the main brushes are fixed in the ordinary or neutral position, and the auxiliary brushes half a pole pitch in advance, being connected to their respective main brushes through a suitable external resistance. The field magnet windings are connected direct to the main brushes, the regulation of the output being mainly effected by the auxiliary brushes and resistance.

In order to clearly follow the action of the machine the various connections and arrangements of pole-pieces and brushes are shown diagrammatically in Fig. 18. The main brushes are shown in the neutral position at A and B, each being connected respectively to an auxiliary brush half a pole

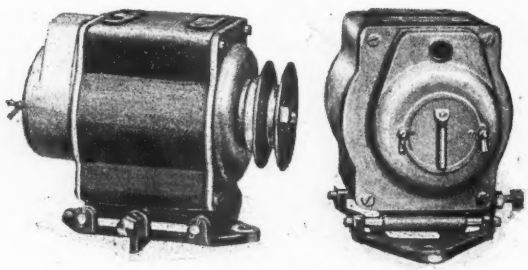

Fig. 17.—T. and M. Car-Lighting Dynamo.

pitch or 90° in advance, i.e., at A^1 and B^1, by means of resistances R and R^1. As the armature C begins to revolve between the poles D and D^1, due to residual magnetism, an E.M.F. is set up between the brushes A and B; which has the effect of sending a current through the shunt winding S S^1, thus building up the shunt field, and it also causes currents to flow in the resistances between the main and the auxiliary brushes and in the armature conductors lying between the brushes A A^1 and B B^1. These currents produce a magnetic flux in the armature parallel to a line connecting a main and auxiliary brush, and its effect is to strengthen the main field. This state of affairs continues until the armature is revolving at a sufficiently high speed to generate the line voltage between the main brushes, which represents the cutting-in speed of the generator. As the speed increases the machine begins to

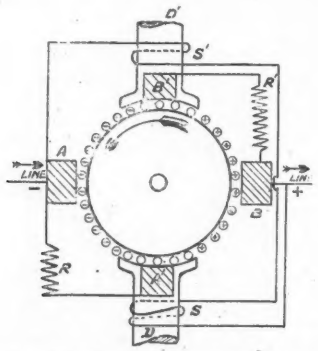

Fig. 18.—Pole and Brush Connections, T. and M. Dynamo.

supply current to the line, and an armature reaction is set up which displaces the axis of the field forward, this having the effect of reducing the current in the resistances R and R^1. When the axis of the magnetic field is displaced by 45° there is no current between the main and auxiliary brushes, as they are then at equal potentials. As the load and speed increases the further displacement of the magnetic field causes a current to again flow in a reverse direction, with the result that the magnetic field is weakened and the machine becomes self-regulating.

It will be noticed that the currents which now flow in the resistances are in the same direction as the main current, so that the auxiliary brushes at high speeds supply part of the main current, and by suitably designing the machine about half of the full load current is supplied by the auxiliary brushes. At full load the armature coils between the main and auxiliary brushes are practically idle and the watts' loss in the armature is stated to be then only half of that of an ordinary dynamo. In other words, given two machines, it is claimed that the T. and M. will not only supply approximately double the current for the same temperature rise, but will also be, other conditions being equal, the smaller machine. The dynamo, battery and lamps are all connected in parallel, and the usual automatic magnetic cut-out is provided to disconnect the generator, as soon as its speed drops below the cutting-in speed, predetermined for the particular voltage of the machine. The dynamo is being made in various sizes, viz., 8 volts and 8-10 amps., and 12 volts 7-8 amps., 10-12 amps. and 20 amps. Curves obtained by practical tests show that once the normal speed—about 1,600-1,700 r.p.m.—is attained, the output of the machines remains constant even up to a rate of 4,000 r.p.m., the fluctuations being only about ½ amp.

The Ducellier.—Although still supplying a permanent magnet machine, Messrs. A. A. Godin have introduced a new 12-volt 200 watt direct-current dynamo. The current output is maintained constant entirely by electrical means, the

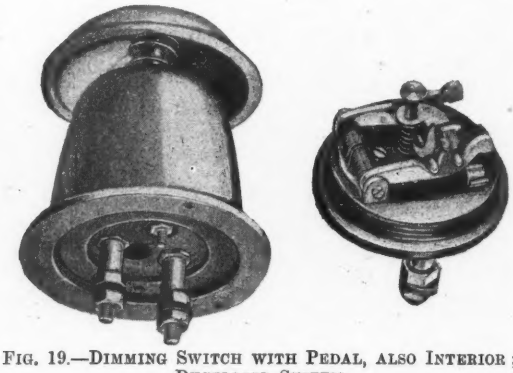

Fig. 19.—Dimming Switch with Pedal, also Interior; Ducellier System.

generator losing its excitation in direct ratio to the intensity of the current, which it is producing and to the increase of its own speed. The minimum dynamo speed cut-out device, which functions at about 400 r.p.m., is of the electro-magnetic variety, with a positive make and break. Mounted on the same base as the automatic switch is another device, which distinguishes the Ducellier dynamo. This is what is termed a security apparatus, it being provided to protect the whole of the installation—lamps, dynamo and automatic switch—

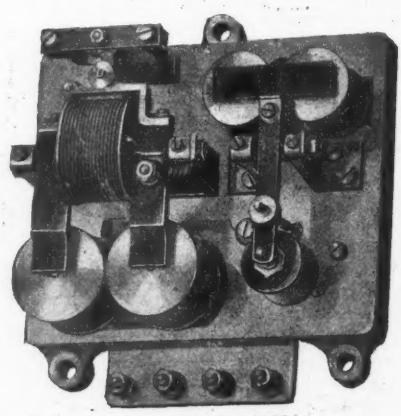

Fig. 20.—Automatic and Excess Voltage Cut-outs; Ducellier System.

against any accidental excess of voltage of the machine. It is composed of a group of shunt windings, which can attract an iron armature, which breaks the excitation circuit of the dynamo. Still another feature of the Ducellier system is the provision of what is termed a dimming switch, by means of which the intensity of the light emitted by the head lights can be reduced when driving through towns or villages at night, or when meeting other cars. It simply consists of a pedal-controlled switch which brings a resistance in circuit with the head lamps.

The S.E.V.—A French machine which has lately come into great prominence is that known both as the S.E.V. and the B.R.C., it being handled in this country under the latter name by Messrs. Fenestre, Cadisch and Co. The feature of the machine is that it is designed to give a constant voltage—8 volts—rather than a constant output, notwithstanding the varying speeds at which it is driven. The controller is mounted on one end of the machine and acts by short circuiting, on a special resistance provided in the shunt excitation. The device consists of a vibrator working in conjunction with a small electro-magnet having two windings—a fine one in shunt with the two poles of the generator and the other a thick one in series with the circuit; the object of the latter being to limit the current output of the dynamo. The arrangement is such that when the voltage obtained is equal to that for which the vibrator has been adjusted, the vibrating blade is attracted to the electro-magnet, and the additional excitation resistance is thrown in circuit. The effect is to immediately produce a drop in the voltage, and the blade resumes its position, short-circuiting the resistance. In practice a nearly constant average voltage is said to be secured. An electro-magnetic switch is provided to cut the dynamo in and out with the battery, as the speed increases or falls, this being mounted on the machine, in conjunction with the voltage regulator, a feature of both being that the moving parts are so arranged that they can be quickly detached and replaced.

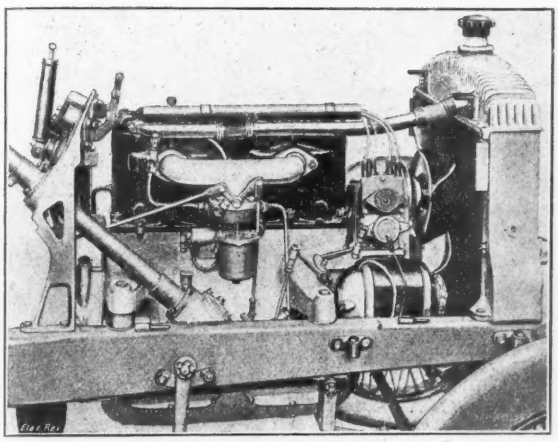

Fig. 21.—Diamler Engine, with Magneto and Dynamo.

The Magician.—This is another French design of machine, handled in this country by the United Motor Industries, Ltd. It is at present made in one size only, 180 watts at 12 volts, the interest centring in the simple yet ingenious means adopted not only to maintain a constant output at varying driving speeds, but also to mechanically close the circuit between the dynamo and the battery when the speed of the former reaches about 800 r.p.m. and to break it when it falls below that rate. This is done by supporting the dynamo in a cradle in such a way that it is free to rock or oscillate in the same. Thus, as soon as the speed of the dynamo reaches a certain limit, the distortion of the magnetic field within the machine causes the shell of the dynamo to rotate on its own axis through a greater or less arc. The cut-in and cut-out switch is mounted directly on the generator, and is provided with a forked trip gear,

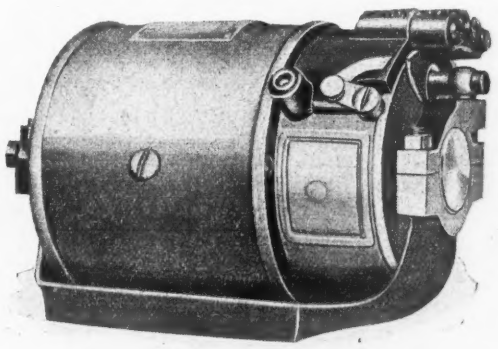

Fig. 22.—Magician Car-Lighting Dynamo.

one or other of the two arms of the latter coming into contact with an arm rigidly fixed on the supports so that as the dynamo moves through its arc, the gear, and through it the switch, is automatically pushed over in the desired direction. The current output is also maintained constant by the same ingenious means, for, by making use of the principle of torque reaction, or the tendency of the magnets to revolve in the direction of the armature rotation, the brushes are automatically placed in a less favourable position as the speed increases, consequently lessening the excitation current, and preventing an increase of output. The United Motor Industries, Ltd., are also supplying a Magician electric engine starting motor, which is provided with an enclosed reduction gear of the epicyclic type.

The Bleriot.—In addition to their series of 8, 12 and 16 volt machines giving outputs up to 350 watts, and which run at a relatively high speed, Messrs. Bleriot, Ltd., have now introduced what they term a slow-running type, designed to give 150 watts at 12 volts. Contrary to the older pattern, in which a constant output is electrically maintained, the regulation in the new dynamo is effected by a centrifugally-controlled slipping clutch forming part of the driving pulley. The machine is of the four pole type with only one pair of brushes. The cut-out device for making and breaking the connection between the dynamo and the battery is mounted on the switchboard.

The Stereos.—The feature of this French-built machine is that to maintain a constant output at different driving speeds, the armature is so mounted on its spindle that while it must rotate with it, its position relative to the field coils is varied as the speed increases. The machine was fully described and illustrated in the issue of the *Review* for the 29th August last.

The Bosch.—At present only a single size of machine is being made by the Bosch Magneto Co., Ltd., this having a normal output of 100 watts at 12 volts, but capable of giving a much higher production without danger of over-heating. Regulation is effected by an external automatic device, which is stated to control a variable resistance in the excitation circuit. A feature of the machine is that the spindle is not located centrally in the casing, as is usual, but is below the centre, this having been done so that it is at the same height from the base as that of the Bosch magneto, it being thus possible, whenever there is room on the engine, to drive the dynamo in tandem with the oil pump, the water-circulating pump, or even with the magneto.

The Gray and Davis.—One of the most interesting of the American dynamos seen at the Exhibition was that of Messrs. Gray and Davis, of Boston, Mass., the feature being the provision for the separate regulation of the voltage and amperage. The machine is compound-wound, but unlike most compound-wound machines used for electric lighting, the two field windings assist instead of oppose each other, it being for this reason called a cumulative-compound instead of a differential-compound machine. The purpose of the additional field is to increase the output of the generator as the lamps are switched on, without increasing the speed of the dynamo. In order to obtain constant armature speed—about 1,200 r.p.m.—two

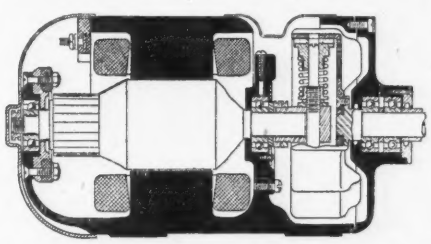

Fig. 23.—Sectional View of Gray & Davis Dynamo.

methods are used in the two different types of dynamo produced, both acting on the centrifugal system. Under normal conditions, with the car engine alternately accelerated and retarded, the dynamo clutch will slip almost continuously,

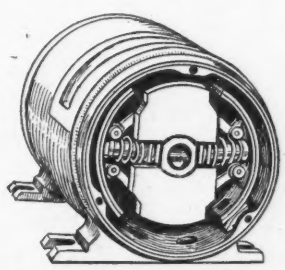

Fig. 24.—Expanding Clutch, Gray & Davis Dynamo.

and, in order to dissipate the heat which is generated, a forced draught through the dynamo is provided by fan-shaped wings cast on the plates of the clutch. In the alternative arrangement, the slipping clutch is of the internal expanding variety. The machine gives current at 6 volts, two sizes being made, in one of which the automatic cut-in switch operates at 750 revolutions, and the other at 1,000 revolutions.

D

The Radios.—This is another new French machine introduced into this country by Nilmelior (England) Ltd. It is made for both 6 and 12 volt circuits, the feature being the provision of a separate current output regulator which acts on the field windings. The dynamo itself is of the usual two-pole shunt-wound variety, provided with an electro-magnetic cut-out.

The Eisemann.—Since the Eisemann dynamo, made by the Eisemann Magneto Co., was described a year ago its design has been somewhat modified. In its latest form it has an output of 180 watts at 12 volts. The feature of the machine is that the control is entirely external, yet built up complete with the generator. Owing to questions concerned with securing the patents, it is not yet permissible to fully explain the electro-magnetic control system. It may be stated, however, that there are three magnetic switches, which act automatically and in sequence, these being mounted on the side of the machine. The first switch cuts in the circuit between the dynamo and the battery when the armature has attained the necessary speed—about 500 R.P.M.—for the charging rate to exceed the normal or battery rate; the second cuts the circuit when the amperage rate is being exceeded, while the third switch acts as a governor on the circuit, and enables the machine to light the lamps without the intervention of the battery.

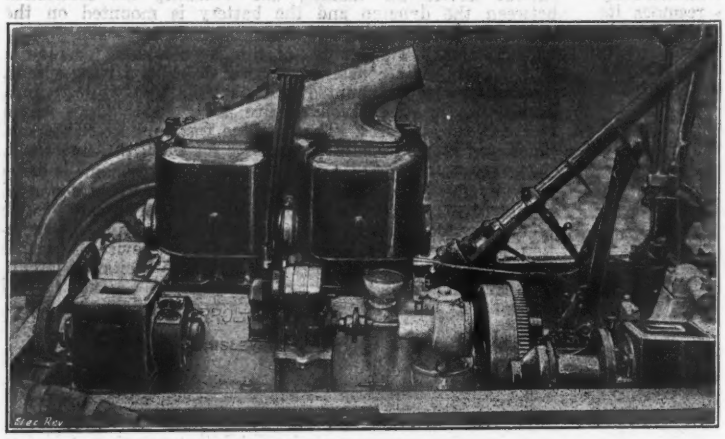

FIG. 25.—ARROL-JOHNSTON ENGINE, WITH DYNAMO, MAGNETO AND STARTING MOTOR (LEFT TO RIGHT).

The Rushmore.—The feature of the 6-volt dynamo set introduced by Rushmore Lamps, Ltd., is the ballast coil which secures automatic regulation of the current output. The field magnets are provided with a shunt winding, which opposes the main coils, between the dynamo and the battery. The effect of the increasing resistance of this iron coil is to divert current to the shunt field windings, and these being in opposition to the main field coils, the net effect is that the current output is prevented from rising.

The Westinghouse.—The American Westinghouse Co. have recently entered the field with a dynamo for car-lighting purposes. It is of the 6-volt type, and arranged to give a different current output when the dynamo is merely charging the battery and when the lamps are switched on, this being effected by a reversed compound field winding. The capacity of the generator is sufficient to not only run the lamps, but, also to always have a small reserve for accumulator charging. Thus when the lamps are switched on, the battery current to the lamps passes through the series winding and so assists the shunt field. As the output of the dynamo increases, the balance of current not required for the lamps, passes to the battery through the series winding in the reverse direction, causing it, in this case, to oppose the shunt field. The usual automatic electro-magnetic cut-in and cut-out device is provided, one of its features being that while it is designed to cut in at a speed of 325 revolutions, the cut out only works when the speed drops to 225 R.P.M., an arrangement which prevents the switch from repeatedly cutting in and out, when the car is travelling at a fairly steady slow speed.

The Bijur.—This machine is made by the Bijur Motor and Lighting Co., who, in developing the same, have worked on the hypothesis that the brushes and the commutator are the only parts which are likely to give trouble, or to require the care that can be given by other than an expert. Consequently all the other parts have been enclosed in a tight casing which cannot be opened except by special tools. The brushes and commutator can be got at by removing small brass plates on either side of the machine. In order to permit the dynamo, which gives current at 6 volts pressure, to be used direct for the lighting circuit, the current regulation is obtained by varying the strength of the shunt-winding by means of a magnetic device which inserts a single step of resistance in the field immediately the output exceeds a certain predetermined limit; when the output drops the resistance is automatically removed. The mechanism by which this action is obtained is enclosed within the dynamo casing, as is also the automatic electro-magnetic cut-out.

The Remy.—Another American machine is the Remy, made by the Remy Electric Co., of Anderson, Ind., U.S.A. It is a 12-volt machine with inherent current-output regulator; the dynamo is of the differentially compound-wound type, the series winding opposing the shunt winding through a third brush so as to produce a characteristic curve, in which the maximum voltage is reached at a moderate speed, and above which no increase of output is produced, irrespective of the speed at which it is driven. A feature of the armature is that the slots of the drum are not of the usual parallel type, but are set at an angle to the spindle, it being claimed that the arrangement adds to the silent operation of the machine. There are two poles, the compound winding being located on the upper part of the field casting. The cut-out device, or reverse current relay—as the makers term it—is designed to function at the relatively low speed of 250 R.P.M.

Other lighting dynamos on exhibition at Olympia which call for no special mention on this occasion—some having already been described in these columns—included the Disco, made by the Disco Co., of Detroit, U.S.A.; the Fulmen or "Orno," of Messrs. G. T. Riches and Co., Ltd.; the Tonelyte, of Messrs. Steiner and Co.; the En Route of the Motor Accessories Co.; the V.R. of Messrs. Van Raden and Co., Ltd.—which is practically identical with that of Messrs. Vandervell and Co.; and the Brolt of Messrs. Brown Bros., Ltd.

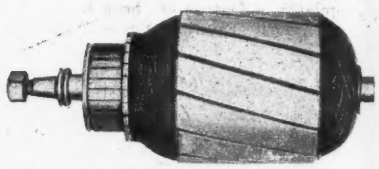

FIG. 26.—SKEW SLOTTED ARMATURE, REMY DYNAMO.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Code Books for Engineers.

It appears to us to be somewhat remarkable that in these days of literary and commercial enterprise someone has not published ere now a comprehensive code book containing code words such as would cover the usual phraseology and requirements of engineers engaged in electrical and electro-mechanical undertakings.

For years we have been patiently hoping that a code book of this description would soon be published, but alas, no, or if so, then we have not yet seen it. We feel convinced that a really good code book, with wide-embracing scope and full provision for condensing the matter into the shortest possible number of words, would amply compensate the publishers by the large demand for copies from all the leading and up-to-date traders and engineers outside the British Isles.

Some of the private code books of manufacturers are most excellently compiled and thought out, and save considerable expense when cabling ; but though private code books may be necessary or advisable, they are certainly of no value in the majority of cable communications between oversea importers and their buyers in England.

It frequently happens, too, that details have to be cabled to sundry firms with whom there may have been little or no previous business, or who possess no private codes.

It is hardly possible to conceive that any other branch of commerce is so badly catered for in this direction, and surely the time arrived long ago when engineering requirements

justified a specially compiled book. The average popularly used codes of to-day containing practically commercial phrases only are certainly of no value for transmitting details such as voltage, phase, cycles, speed, candle-power, type of motor, method of coupling, efficiencies, and the hundred and one other important detail matters daily dealt with.

Take an example. A quotation is required from a definitely specified manufacturer, with whom no previous business has been done, and who has no oversea local representative, the inquiry being for a direct-current motor-generator with common bedplate, rigid or other coupling, motor three-phase, 400 volts 100 cycles, suitable starting gear, generator direct current, 100 volts 180 amps., over-compounded 5 per cent., with shunt regulator, machines to be totally-enclosed type, speed not exceeding 900 R.P.M.

Are there any public code books now on the market which could condense the above cablegram to a reasonable number of words—say even six words?

For **Newton, McLaren, Ltd.**
D. Eardley McLaren, *Managing Director.*

Adelaide, South Australia,
November 5th, 1913.

Electric Clocks.

Your correspondent says it would interest your readers to know the principles of electric time service which distinguish fundamentally between the two systems named. If you agree with him and can spare the space, I will express them as concisely as possible.

The energy devoted to making contact should not be taken from the pendulum, which ought to be left undisturbed in performing its only true function — time measurement.

The electromagnet used to maintain its oscillations may provide unlimited energy to perform a powerful switching operation, but that energy should not be first put into the pendulum and then taken out of it. A Foucault-Hipp driven pendulum is the worst for such treatment, because the amplitude of its oscillations is perpetually varying in irregular frequency, which has no relation to the half-minute function of making contacts to operate dials.

It is undesirable and inefficient to have to arbitrarily adjust the duration of the contact to the supposed requirements of the dials; on the other hand, their self-induction should dictate the duration necessary.

The contact should not pass what current is available regardless of its sufficiency or insufficiency; on the other hand, it should be compensatory in its action, passing enough current to operate all dials under varying conditions of battery, &c., or else ceasing work altogether, after giving due warning of impending failure.

I have enunciated these principles fearlessly as a fundamental statement of right and wrong, and they have never been called in question. There is only room for difference of opinion as to their importance in practice.

The oscillographs in my I.E.E. paper laid the "short-contact" bogey in 1910.

F. Hope-Jones, M.I.E.E.

Clerkenwell, E.C., *December 8th*, 1913.

My original letter in your issue of November 14th was penned with no other motive than that of asking for public recognition for Mr. G. B. Bowell's 20 years' work in electric clocks; and as my letter was in no way intended to draw any comparisons between rival trading firms, nor did I even mention any electric clock system by name, I did not propose to make any reply to Mr. Hope-Jones's letter—although I could not help smiling at the idea of my brother's "habitually transgressing the principles of electric time service."

Mr. Bousfield's letter is most interesting, since it voices what I believe to be the opinion of most experienced users of electric clocks.

H. T. W. Bowell.

London, E.C., *December 5th*, 1913.

The New "Journal" of the I.E.E.

Not so long ago we heard a great deal about the "dignity" of the Institution of Electrical Engineers; does this account for raising the Institution *Journal* to the dignity (?) of a penny magazine? Those who, like myself, keep their *Journals* in a book-case, will not welcome the change in the size of the volume; moreover, the penny magazine edition is very difficult to keep in good order for binding, as it gets inadvertently doubled over, and the corners get turned up; in short, being now a magazine, it is difficult to avoid its being treated as such rather than as a book. I shall be glad to hear for what reason the change has been made.

J. W. Record.

Manchester, *December 3rd*, 1913.

Electric Vehicles.

Referring to the remarks at the inaugural luncheon last week, on the occasion of the opening of new showrooms by Edison Accumulators, Ltd., it would be a pity at the present stage of electric vehicle development in this country, if the general public interested in commercial trucks formed the opinion that the success of these is dependent on the supply undertakings being able to furnish energy at a halfpenny per unit for charging purposes. As a matter of fact, even at the price of one penny per unit for vehicle charging, at the off-peak load, the cost is 33⅓ per cent. lower than in America, where this industry has assumed very large proportions, and the rates charged vary from 3 cents to 5 and 6 cents per KW.-hour. The cost of power for operating a self-propelled vehicle is only a small proportion of the total cost, as the per cent. cost figures given below will show. The horse has had a time-honoured monopoly of the goods-carrying industry, and is still an institution in this country for city haulage work, as the invasion of his territory at the present time by commercial petrol trucks does not amount to much. A very different state of affairs exists to-day in America, where this field has now been highly developed and specialised, with the result that the horse is rapidly disappearing from the city streets, and delivery work is being speeded up and carried out either by electric or petrol trucks, each type in its own special field of application, the electric being used for short-haul, frequent-stop delivery, and the petrol for long hauls. In its proper field, up to 30 to 40 miles per day on one charge, the electric truck has proved itself to be the cheapest goods carrier, and its popularity and success are proved by the number of vehicles of this type in daily use in all the large cities. The last three years have witnessed the real development of this industry over there, and the success of the modern electric is due to advances in design and construction and improvements in batteries, which give the present type an increased range of operation on a charge of from 30 to 40 per cent. The Electric Vehicle Association of America has played an important part in this development, and the formation of a Committee of the I.M.E.A. in this country on the same lines and the work now being taken in hand are of great importance at this juncture, as the question of charging arrangements and facilities presents considerable difficulty to prospective users of this type of truck at the moment.

Trucking data costs on 1,000-lb., 2-ton, 3½-ton and 5-ton trucks for electric, petrol and horse vehicles have been worked out by the Mass. Institute of Technology, based on operating cost figures taken over a large number of observations, and the average results on all four sizes of vehicles give the following per cent. items of operating cost per mile:—

	Electric.	*Petrol.*	*Horse.*
Storage, drivers and help...	46 %	41 %	54 %
Maintenance	30 %	28 %	11 %
Standing charges	17 %	22 %	11 %
Electricity, petrol or feed	7 %	9 %	24 %

These figures are interesting, as showing the relative proportion of each item of cost for each type. The electric and horse trucks were in use for 285 days out of 300 days per annum, and the petrol trucks for 270 days, the average mileage per annum being 9,137, 9,200 and 6,525 for electric, petrol and horse truck respectively.

The higher depreciation and insurance rates on petrol trucks are shown in the high per cent. cost, as against

electric, and on the other hand, the per cent. maintenance cost on electric, as against petrol, is slightly higher, but the maintenance figure covers a replace battery each year for the electric.

As petrol costs 1s. 6d. a gallon here to-day, as against 16 cents or 8 pence in America, the equivalent English figure to take for comparison is 1s. 3d. per gallon, which for the same consumption and mileage would bring up the per cent. cost of petrol to nearly double the American figure, and the per cent. cost for electricity here for electrics would be reduced by 33 per cent. on the basis of a 1d. per unit rate.

G. E. Clarke, M.I.M.F.

Birmingham, *December 8th*, 1913.

Electrical Accidents in Mines.

Your correspondent "Armour" has drawn attention to a subject that is well worth discussion, in his advocacy of the armouring of all cables used underground. There are, however, several points in his letter that are not accurate, which detract from the strength of his arguments, and we think it necessary to draw attention to these.

In the first place, armoured trailing cables have been well tried (as seemingly evident to others besides "Armour," as the most suitable to resist falls and abrasion), but there are few mines which have not dropped them, for the following defects:—Weight, inflexibility, "kinkability," and permanent flattening by concussion.

Secondly, jute, leather and whipcord, though stated to be insufficient protection, have all been largely used and have generally been found more satisfactory than armour.

Thirdly, lead covering (said not to "suffer greatly") is absolutely useless for trailing cable work, and it is *not* "the toughest covering short of armouring."

Fourthly, the solid rubber sheathed cable originally introduced by us as cab-tire sheathed cable is stated to be "the most expensive form of protection." It may be, in first cost, up to twice that of most types of trailing cables. It is remarkable, however, that this "most expensive" type is probably now more in demand than any of the others, seeing that mining men are not in the habit of paying more for an equally good (or poor) article.

Fifthly, as to armouring being necessary on repaired cables. Repairs on C.T.S. cables are now made with our patented vulcaniser by colliery electricians in such a neat and efficient manner, that it is almost impossible to discern the repaired place, and it is practically as good as new. (We send the Editor a joint to examine, to prove this.) An armoured cable could not be anything like so simply and effectively repaired at the colliery.

Sixthly, the coincidence mentioned as to Scotland being most immune, and that it used the best trailing cables, is quite correct. There is a greater percentage of C.T.S. trailing cables in Scotland than in any other mining district in the United Kingdom, and probably more of them are now in use there than all the other types combined.

Briefly, the advantages of the C.T. sheathed cables over, at least, any armoured cable, have now been well proved for most situations where trailing cables are used, and to argue this point further seems to be a waste of time, as well as little-needed advertisement for that type of cable.

St. Helens Cable and Rubber Co., Ltd.,
J. H. C. Brooking, *Manager.*

Warrington, *December 8th*, 1913.

The Association of Mining Electrical Engineers.

I am glad to see in your issue of the 5th inst., the publication of a letter from Mr. W. Baxter (of the North of England Branch) referring to the assertions respecting the above Association contained in a leading article in your paper of the 21st ult.

Will you please allow me to say that I quite agree with Mr. Baxter's letter, and that I could go much further did I think it either necessary or desirable.

Assertions such as you made in your article—unbacked as they were by any statement of proof—are not, I think, likely to have much weight with your average reader, and none so far as the members of the A.M.E.E. are concerned, any one of whom could easily prove a direct negative to some of your remarks anent the Association.

In the same issue in which this leader appeared (on page 816, middle of second column), in the conclusion of an article on "Electrical Accidents in Mines," an accident which took place at a South Staffordshire colliery is referred to, and you make three queries, as follows:—

1. Who was the competent electrician? and what training had he?
2. Was he a member of the A.M.E.E.?
3. Did he hold a certificate granted by this Association?

As president of the Warwickshire and South Staffordshire Branch, I can definitely state that he was not a member of the A.M.E.E. and, therefore, the third question does not require an answer, and, moreover, would never have been asked had the writer read the rules of the Association. As regards the first question, I would refer you to the writer mentioned in your editorial comment on Mr. Baxter's letter, "who is familiar with almost every colliery in the country." He should assuredly be able to impart to you the precise information.

With Mr. Baxter, I much regret that you should, seemingly, be so averse to this Association, and that only on apparently a very slight insight as to its inner workings, and the class of its members. I can only think of one possible "grievance" (as Mr. Baxter puts it) that you might have—and that will be fairly obvious to our members. If there is really anything in such surmise, then your antagonism is all the more regrettable.

I trust you will give this letter the same publicity as your articles.

Arthur Hall.

Nuneaton, *December 8th*, 1913.

[We wish to do full justice to the Association, and should be only too glad to publish proofs that we had been misled as to the nature of the membership of the Society—if they were forthcoming. As stated in our note, our view has been privately supported by a leading official of one branch of the Association, and therefore is not unbacked.

If we criticise the Government of our country, are we necessarily unpatriotic? It is not the Association that we find fault with, as an Association, but its composition, which, we maintain, is not what the founders intended it to be. We welcomed their proposals, and supported their aims; but the Association has been captured by those whose interests are not in harmony with the interests of the real colliery electricians, and who are not likely to place the latter before the former, lest they should weaken their own monopoly of power and responsibility. Mr. Hall's last paragraph appears to suggest that we have some personal "grievance" against the Association; nothing could be further from the truth. On the contrary, we wish to see it prosperous and strong to carry out the main object for which it was established—namely, in the words of the first president, to establish a professional class of mining electrical engineers. We have consistently adhered to this view from the formation of the Association, which derived its origin from our own suggestion in December, 1908—a fact which in some measure entitles us to criticise its doings.—Eds. Elec. Rev.]

Canadian Electrical Trade.

In response to Mr. Herbert H. Berry's invitation in his latest letter to you on the above subject, I would say that in my own British experience I have not known the presence or absence of a fibre lining to a 3-ampere switch to have had any observed effect upon the electrical fire risk during, say, the last 25 years.

Upon these grounds, I do not examine or inquire as to whether such linings are or are not used, the point having been shown to be without interest from my own standpoint.

A. Lester Taylor.

Liverpool, *December 9th*, 1913.

Graphs in a Cable-Ship Drum Room.—We have received a long letter from Mr. E. Raymond-Barker, dated December 8th, in reply to the review on the book named above, but unfortunately we are compelled to hold it over on account of pressure on our space.—Eds. Elec. Rev.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Electric Comb.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W., are introducing a seasonable device in the shape of the electric comb and hair dryer, illustrated in fig. 1. Reasonable in price, easily adapted to the home and inexpensive in use, it is claimed that the Plexaim comb dries the hair quickly and in a natural manner, producing a soft and silky appearance.

The comb, which has a power consumption of 40 watts, is supplied with flex and adaptor for an ordinary lamp socket, and a neat attachment can also be supplied where single lamps are in use, by which the latter can be kept lighted while an extra socket, suspended underneath, is available for the adaptor. The company holds large stocks, and will supply suitable literature to those desiring it.

Fig. 1.—Electric Comb and Hair Dryer.

Domestic Wall Plugs.

One of the requirements of a wall plug for safety in domestic service is that it must not be possible to make contact with the terminal pins when the pins are alive. In order to effect this, the cover of the plug should project over the terminal pins, so that no portion of the pins is visible when the plug enters the socket.

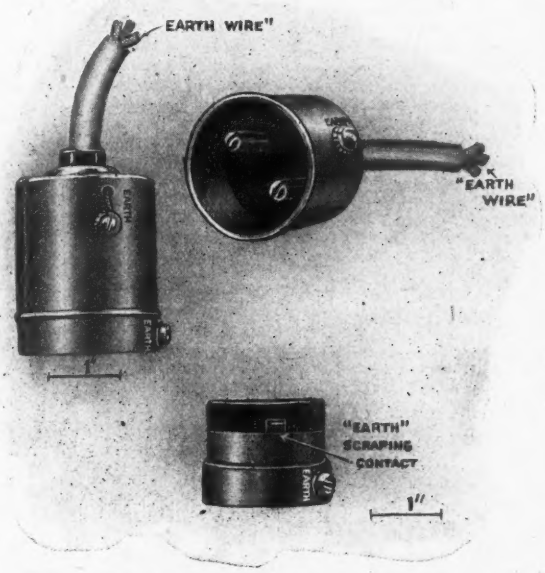

Fig. 2.—Reyrolle Wall Plug, showing interior.

This method is sometimes adopted on kettles and other domestic apparatus, but there is room for a much wider application of it.

The earthing arrangements which for years have been applied to flexible conductors in use in factories serve also a good purpose in the home, particularly where any form of portable electrical apparatus is used near to water-pipes, gas-pipes or other metalwork at earth potential. It may be argued that it is unnecessary to earth the cases of electrical appliances which are used in a drawing room or dining room, where, thanks to the insulation of carpets, floors, &c., there is no danger of shock. This is true to some extent, but there are a number of cases where one unexpectedly finds "earth" in a room—for instance, disused gas-pipes, fireplaces, sometimes with an old connection to a gas stove, bell wires, &c. It is a simple matter to make a metallic earth connection to the plug socket wherever an electrical apparatus is used near to water-pipes or taps, because the earth wire need only be run to the pipes. Then, in those rooms which are perfectly insulated, it is agreed that there would be no danger in omitting the earth wire from the socket; indeed, under some conditions, it might be safer to do so. But to make all heaters in the household interchangeable, the same form of plug and socket must be used throughout.

The accompanying illustrations, fig. 2, show a plug made by Messrs. A. Reyrolle & Co., Ltd., of Hebburn, which was originally developed for use in factories, and has now found a further field in domestic work.

Electrical Floor Polisher.

We illustrate in fig. 3 a new machine for surfacing, polishing, cleaning, or renewing all classes of floors, either wood, composition, rubber or stone.

Such work has hitherto been an expensive process, entailing highly-skilled labour at the outset, and a continuous after expense for maintenance.

The machine is self-contained, with a small motor, and is operated from the ordinary lampholder or wall plug by a flexible cable; it is easy to handle, and the attachments, which include various brushes, polishing pads, sandpaper disks, carborundum stones, &c., are interchangable.

Fig. 3.—Electrical Floor Polisher.

The makers, Messrs. Surfacing Machinery, Ltd., of 118, City Road, E.C., are prepared to give estimates for high-class floor finishing polishing, or resurfacing, and to contract for periodical polishing in hospitals, ballrooms and public buildings, in connection with which the machine has met with considerable success.

Auto-Transformer Starters.

The increasing use of squirrel-cage motors of comparatively large power has led the Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, London, to develop an auto-transformer suitable for these. As may be seen from the accompanying illustration, fig. 4, the switch is of the drum type the live parts being clamped on steel bars with substantial moulded mica insulation, and is fitted with E.A.C. self-aligning finger contacts. The whole is very easily accessible, and the drum may be removed without disturbing any other part, or undoing any connections. The switch is arranged with four positions:—

(*a*) Off—Completely disconnecting the motor from the mains.

(*b*) Starting—Connecting the transformer, giving 40 per cent., 60 per cent., 75 per cent., or 85 per cent. of line voltage, according to the tapping selected.

(*c*) Transition—Making connections as in (*b*), and also connecting the motor direct to the mains through a buffer resistance.

(*d*) On—Connecting the motor to the mains direct, the transformer being no longer alive.

The E.A.C. slow-motion device is fitted, allowing rapid motion from step to step and through the transition connection, but

ensuring a definite stop in the starting position. The positions are consecutive, and the handle will not remain in either the starting or transition position, so that the starters are fool-proof,

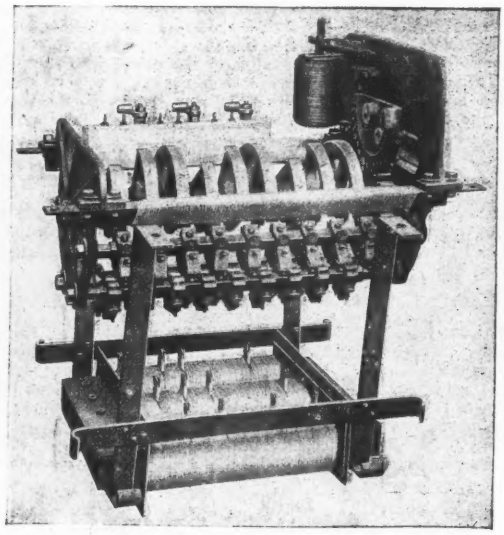

Fig. 4.—Auto-Transformer Starter, with Outer Case Removed.

while the provision, if desired, of no-volt and overload releases completely protects the starter and the motor.

Laminated Gears.

A remarkable step forward in the design of gears was recently put before us by Mr. A. F. Evans, the invention of Mr. A. E. Terry, of Messrs. Herbert Terry & Sons, Redditch. The object specially aimed at is silent running, but other important advantages are gained which should ensure the immediate popularity of the new gear. The accompanying illustrations show the construction of the gear-wheels, which are made of thin plates of steel, with the teeth not machine-cut, but notched out like armature core plates. The alternate plates are staggered half a tooth, as shown, and riveted together to the required total thickness. Any metal can be used, and any pitch or shape of tooth, and the disks can be punched with key or spline ways to fit on a spindle or arranged to be carried on a spider. The disks are accurately set on the tooth-notching machine by the bore and keyway, so that when cut they are all identical in all respects except that already mentioned, namely, that alternate plates have their teeth phased half a tooth from the teeth of the adjoining plates, thereby halving the virtual pitch and doubling the number of contacts. Large wheels

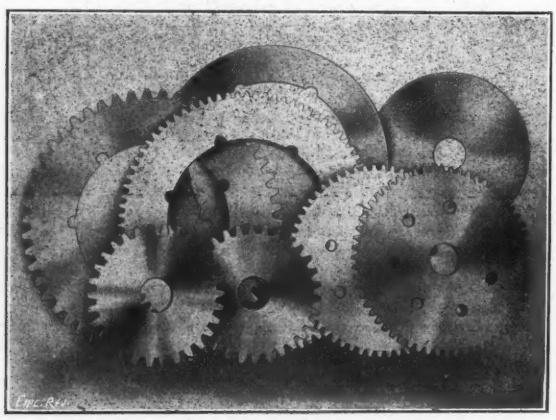

Fig. 5.—Laminated Gear Wheels.

are built up of rings or segments, carried on spiders, and their size is limited only by the latter. The teeth may be hardened without fear of distortion, and the whole process of manufacture is extremely simple and economical, the tools required being also much cheaper than the milling cutters used for milling gears out of the solid. Any width of face can be supplied. Between adjoining plates a very thin washer is inserted, to provide clearance for the teeth to pass without friction. It is claimed that these laminated wheels run together as silently as raw hide or silent-chain gear; the wheels cannot ring or hum, owing to their construction, which makes them as free from resonance as if they were made of lead. A special factory has been built for the manufacture of the gear wheels at Owlerton, Sheffield, and a private company has been formed to carry on the business.

The wide range of applications for the new wheels hardly needs emphasising; it includes practically all the purposes for which spur gearing is employed. A special advantage is the reliability of the built-up wheel, as the breakage of a tooth does not interfere with the continued use of the gear. Electric motor drives in particular, which are so often used where noisy gearing is a serious

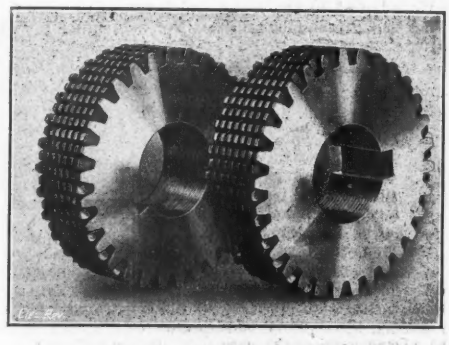

Fig. 6.—Disks for Laminated Wheels.

nuisance, will benefit greatly by employing these wheels, which, moreover, can be made of smaller dimensions for the same ratio of reduction. In the case of large gears only a small stock of spiders need be carried, the laminations being chosen to suit requirements. Automobile and tramway engineers will find the laminated gears especially useful.

LEGAL.

P.M.G. *v.* Hendon U.D.C.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Swinfen Eady and Phillimore, on Monday, upon the appeal of the Postmaster-General from a decision of the Railway and Canal Commissioners, consisting of Mr. Justice Bankes, the Hon. A. E. Gathorne-Hardy, and Sir James Woodhouse, in relation to differences which had arisen between the Post Office and the Hendon Urban Council as to placing telegraph poles and wires in certain roads within the jurisdiction of the Council. It appeared that there were three roads within the Council's jurisdiction which had been laid out, but none of which, at the date of the action, had been taken over by the Council. The Postal Authorities desired to place telegraph wires and poles along those roads, and made the usual application for authority, which the Council declined to give. The case then went before the County Court Judge, when the Council raised the point that the roads had never been dedicated to the public, and the County Court Judge having decided in favour of the Council, the Postmaster-General appealed. The Council admitted that the three streets were public roads, and that, as regards one of them, notices had been served upon the frontage owners requiring them to make up the roads. The only point which the Court had to decide was whether the roads were under the control of the Council. Sec. 13 of the Act provided that where anyone was responsible for the repair of the road, the consent of such person must be obtained before any poles or wires could be placed over or along same. It had been contended that the roads, not having been taken over by the local authority, were not under the Council's control, but on the other hand, it was contended by the Postmaster-General that the obligation to repair the road was not necessary in deciding whether the road was under their control.

Mr. Justice Bankes and the Commissioners held that the present case could not be distinguished from that of the Reigate Rural Council case, in which the Divisional Court had held that a street did not come under the control of a local authority until it was taken over, and they entered judgment in favour of the Hendon Council, but, in the circumstances, without costs.

The Attorney-General, the Solicitor-General, and Mr. Bremner appeared in support of the appeal, and Mr. Foote, K.C., and Mr. Goddard for the District Council.

The Attorney-General having dealt exhaustively with the statutes bearing on the subject, contended that the "body having the control of the streets," was an expression as used in the statutes which covered the Highway Authorities, and that local authorities had within the meaning of the Telegraph Acts the control of the street, whether it was a street vested in them, or whether it was a highway not vested in them, and therefore that the decision of the Commissioners was wrong.

Mr. Foote, on behalf of the Council, contended that the Council was not a body having the control of the streets in question, and he said he did not raise any question as to the nature of the streets and highway. He submitted that in the circumstances the decision of the Commissioners was right upon the various statutes governing the subject, and that the appeal ought to be dismissed.

Their Lordships held that the Urban District Council had not, within the meaning of the statute bearing on the question in dispute, control of the streets or roads in question. The judgment of the Railway and Canal Commissioners was therefore right, and the appeal must be dismissed with costs.

The National Telephone Co.'s Assets.

Mr. Percy Wheeler, on December 5th, applied to Mr. Justice Sargant with reference to a summons relating to the distribution of the above assets.

A summons, he said, was taken out before the Long Vacation, and was before Mr. Justice Astbury, but that learned Judge said he felt a difficulty in dealing with it, as he, as counsel, had been concerned in the matter. The liquidator now found himself with £60,000 in his hands undisposed of, and he desired the direction of the Court as to its disposal. Mr. Justice Astbury, to whom he had applied, did not desire to deal with the summons, and he accordingly applied to his Lordship to hear it.

His Lordship asked whether it was necessary to dispose of it before Christmas.

Counsel said it was very desirable that it should be determined speedily and it would not take long.

His Lordship said then the summons might be in the paper for hearing in the afternoon of Monday, December 15th.

Wolfram Lampen Atkien-Gesellschaft *v.* Burns, Harris and Werth.

In the King's Bench Division, on December 3rd, this pending action was mentioned to Mr. Justice Channell. Mr. Compton Smith (for the defendants) said the hearing was at present fixed for December 15th and the case was in the non-jury list. He asked that it should be made a jury case because of the issues involved. The action was brought by the plaintiffs for the price of electric lamps supplied, and, among various defences, it was alleged that the plaintiffs represented that the lamps would not be an infringement of the Osram patents. Defendants alleged that the lamps did infringe those patents, and Mr. Justice Lush had made an order that that question should be deferred until the trial of the other issues.

The Hon. M. Macnaghten (for the plaintiffs) resisted the application, and said there was no allegation of infringement when the case was ordered to be put in the non-jury list. There was a question as to whether there was a warranty attached to the sale of the goods, and that was eminently a matter for a Judge sitting without a jury.

His Lordship refused the application.

The British Vacuum Cleaner Co., Ltd., *v.* James Robertshaw & Son, Ltd.

In the Court of Appeal, the Master of the Rolls and Lords Justices Eady and Phillimore delivered, on December 9th, their reserved judgment on the appeal of the defendants in this action from a judgment of Mr. Justice Sargant. The plaintiffs brought the action for an injunction to restrain an alleged infringement of Letters Patent No. 17,433, of 1901, granted to Mr. Hubert Cecil Booth for improvements relating to an appliance for the extraction of dust from carpets and other materials.

The Master of the Rolls was of opinion that though the patent could be supported on the construction put upon it by the House of Lords limiting the specification by that construction, the defendants had not infringed.

Lord Justice Phillimore, however, was of opinion that the judgment of Mr. Justice Sargant was right, and the defendants had infringed the patent.

By a majority of the Court the appeal was allowed, and judgment entered for the defendants with costs.

Hutchins *v.* L.C.C.

In the King's Bench Division on Thursday, December 4th, Mr. Justice Ridley, with a common jury, heard an action against the London County Council, as owners of the electric tramway system, in which was involved a novel claim for compensation.

On March 4th last Henry Hutchins, an engineer's fitter, at 12.30 (midnight) hailed a tramcar near the Angel at Islington, and as it failed to stop he ran after it to the next stopping place in the City Road, and was out of breath when he reached it. He alleged that directly he was seated the conductor came to him and demanded his fare. He protested that he first desired to recover his breath, upon which the conductor took him by the coat-collar and flung him from the car injuring his knee, for which injury he claimed compensation. He had not been able to trace the conductor.

Mr. Cecil Walsh, K.C., appearing for the defendants, offered to bring 22 conductors into court, 11 who might have been on the route that night, and 11 who undoubtedly were not there, in order to give the plaintiff a wide field for identification.

The 22 conductors were accordingly paraded, wearing their hats, before the plaintiff, but he was unable to identify the man by whom he said he had been assaulted. He stated that he had his ideas, but would not like to swear as the men were so much alike.

His Lordship said that if a conductor had flung the plaintiff out of the car, as he said, the man had exceeded his duty, and the defendants could not, therefore, be held responsible for the act. According to the Council's Tramway Rules, if a man refuses to pay his fare, the conductor has only the power to take his name and address. He held that there was no case to go to the jury. He believed that the man had met with a serious accident, but as the conductor had acted outside the scope of his employment, the Council was not responsible.

Judgment was therefore entered for the defendants.

Dublin County Council *v.* Postmaster-General.

In the Nisi Prius Court, on the 1st inst., before Mr. Justice Dodd, the hearing of this action was resumed. According to the *Freeman's Journal*, the plaintiffs claim a declaration from the Court that the Postmaster-General is bound to carry out the agreement entered into by the National Telephone Co. to supply telephone communication and apparatus to the offices of the Secretary of the Council, the County Surveyor, and the solicitor to the Council. The Council's contention is that the Postmaster-General in taking over the business of the Telephone Co. also took over its agreements with, and liabilities to, the plaintiffs. This the Postmaster-General denies. In the statement of claim it was set out that the company agreed to pay the Council 1s. for each pole erected or to be erected in the County Dublin, and also to pay an annual rent of 1s. for each wayleave granted by the plaintiffs between December, 1903, and December, 1911. It was also set out that the poles remained, and that they were subject to all the wayleaves and other rentals, and that they were now being used by the Post Office.

The defence set out three main objections to the claims:—First, that the plaintiffs' course was to proceed by petition of right; second, that the questions should be settled by the Recorder of Dublin or some tribunal other than the High Court; and third, that the contracts could not for various reasons be carried out.

The arguments having concluded, judgment was reserved.

Edwards *v.* Brixham Gas Co.

In the Chancery Division on December 9th Mr. Justice Neville had opened before him this action, by which the plaintiff sought an injunction and other relief in respect to an alleged nuisance caused to his property by the working of the defendants' electric light plant.

Mr. Peterson, K.C., and Mr. Maugham were counsel for the plaintiff, and the defendants were represented by Mr. McCall, K.C., and Mr. Palmer.

In opening the case Mr. Peterson said that it was brought to restrain a nuisance which was caused by the working of the gas engines for the defendants' electric lighting undertaking at Brixham. The plaintiff was a tailor carrying on business at 50, Fore Street, Brixham, where he resided. Besides owning that house, he had some cottages at the rear, abutting on Gas Lane and Angel Lane, one of which was connected with his Fore Street premises by a bridge, and was used as a store room or workroom. Fore Street, counsel understood, was the chief street in Brixham. It was in Commercial Street, with shops on each side. The tenants of three of the plaintiff's cottages had left owing to the nuisance that was caused by the defendants' works, the vibration being such that it was impossible for them to remain. Under the Electric Lighting Act of 1906, the defendants were authorised to extend their works, and to supply both gas and electricity. Taking advantage of that authorisation, they had greatly extended their works, and the electric lighting engines had been placed immediately opposite one of the plaintiff's cottages. The result of the vibration had been that the plaintiff's wife had suffered from headaches and nervous excitability verging on to a nervous breakdown, the plaintiff's son Douglas, aged seven, had had his recovery from an illness retarded, cracks had appeared in the chimneys and ceilings of the plaintiff's house, plaster was continually falling down, and the hinges of the front doors of the cottages had been broken off.

His Lordship asked when this state of things first started.

Counsel said that it had been going on from December, 1911, when the plant for this electric supply was increased. The defendants denied the nuisance, and said that these works were of the very best design and were worked with skill and care. He, however, should call evidence to show that the nuisance was such that the tenants had found it impossible to remain in the cottages.

Evidence was given as to the effect of the vibration, and the hearing was adjourned.

Alker *v.* St. Helens Corporation.

At Liverpool County Court, on the 8th inst., before Judge Thomas, an action was brought by Wm. Alker, farmer, Haydock, against the St. Helens Corporation, to recover damages for the loss of two horses, alleged by plaintiff to have been killed by a "live" tramway wire belonging to the defendant Corporation. It was stated by counsel, and given in evidence, that, following upon stormy weather, a telephone wire in the neighbourhood of Haydock House Farm, St. Helens, farmed by plaintiff, on May 9th last came into contact with an electric tramway wire in connection with defendants' tramway system, and becoming thereby charged with electricity, fell upon and killed two of the plaintiff's horses. He claimed for the loss of the animals, damage to harness alleged to have been caused by the electric wire, and the cost of the hire of two horses pending the purchase of two others.

Mr. Kennedy, for the Corporation, submitted, and called evidence to the effect, that the contact between the telephone wire and the electric tramway wire did not take place at the point

where the plaintiff alleged, and that defendants had been in no way negligent; also that the guard of the tramway wire was kept in good repair and regularly inspected.

His Honour, in the result, said he had come to the conclusion that contact did take place between the telephone wire and the feeder wire of the tramway system between the posts mentioned, and he gave judgment for plaintiff for £81, and costs.

Grant Finance Co., Ltd., *v.* Victoria Falls and Transvaal Power Co., Ltd.

On Tuesday Mr. Justice Pickford gave his reserved judgment in this action, to which we referred briefly in our issue of November 28th. The result was that the defendants substantially succeeded in the action, his Lordship's decision being in their favour except as to the commission upon the continuous or discontinuous supply under Clause 11.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Erg" writes:—"Sec. 15 of the 1909 Electric Lighting Act provides for a minimum annual sum to be paid by the consumer to the authority for a stand-by supply. In the event of the consumer deciding to take his lighting and power supply from the authority, and to put down a gas-driven generator for plating, arc lamp, or furnace work, would the authority be entitled to raise its charges for lighting and power above those current in the district or alternatively to make a fixed annual charge (under this section) based on the capacity of the gas-driven generator, for which no s and-by supply is connected?

*** Sec. 15 of the Act in question provides that "Notwithstanding anything in the Electric Lighting Act or in any Act of Parliament or provisional order authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises; the sum to be paid shall be determined in default of agreement by arbitration." It is conceived that the real meaning of this clause is that the undertakers are only entitled to insist upon payment in respect of a stand-by when the current used from the mains is to perform the work of the stand-by plant. Upon the facts stated it does not appear that the plating, arc lamp, and furnace work are ever to be done by current supplied from the mains.

It would, of course, be possible to argue that the words "possible supply" which appear in the section include every source of electricity on the premises. Thus the undertakers may contend that some day the gas-driven generator will break down and that the consumer will then be compelled to fall back on the mains. If the definition of "separate supply" is the same as it is in the London Electric Supply Act, 1908 (8 Edw. VII, Ch. clxvii), this would certainly be correct, as "separate supply" is there defined as "either electrical energy produced on such premises or a supply from any other source"; and "Erg's" works may be within the district of one of the companies scheduled to that Act, which includes the Charing Cross, West End and City Co. If "Erg" disputes the charge he is entitled to have the question settled by arbitration.

BUSINESS NOTES.

Private Arrangements.—Jackman & Marchant, electrical engineers, 81, Sandgate Road, Folkestone.—The creditors interested herein were called together last week, when a statement of affairs was presented showing the position as at December 1st last, which had been prepared by Mr. H. H. Barton, I.A., 69, Sandgate Road, Folkestone. The statement disclosed ranking liabilities of £1,875, of which £1,281 was due to trade creditors and £490 to cash creditors, while the bank was also set down for £104. The assets were estimated to realise £630, from which had to be deducted £108 for preferential claims, leaving net assets of £522, or a deficiency of £1,353. The business was acquired by the debtors in May, 1906, the purchase price being £400. The debtors had a small capital of their own, and in order to enable them to complete the purchase price they borrowed £390, which was still owing. They had since borrowed a further £100, which made the £490 shown on the statement owing to cash creditors. The greater part of the borrowed money was obtained from the respective wives of the debtors, and it was intimated that they would defer their claims if a composition was accepted by the creditors. The present deficiency was attributed to losses by bad debts and in trading prior to 1911, together with the depreciation written off the assets and the drawings. In 1911 the business was carried on at a net profit of £320, while the drawings were £360. The following year the net profit rose to £470, while the drawings were £390. During the past 12 months the trading resulted in a net profit of £380, the drawings being £350. In answer to questions, it was stated that the debtors had recently been pressed by creditors. In order to protect the assets from a suing creditor a deed of assignment had already been executed. On behalf of the debtors an offer was made of a cash composition of 5s. in the £. An increased composition was pressed for, and the offer was amended to one of 6s. 8d. in the £, payable in cash. That offer was decided to accept, and it was also resolved that the deed already executed should be confirmed. The following are creditors:—

Pope & Co., Ltd.	£166	Durnier & Co.	£46
Electrical Co., Ltd.	101	New Ever-Ready Co., Ltd.	67
Henley's Co.	82	Pilkington Tile and Pottery Co.	35
Chapman & Co.	21	Sonter & Co.	33
Clark, Hunt & Co.	34	Smith & Co.	20
Camburn, Folkestone	42	Veritys, Ltd.	52
Colpeck, Folkestone	23	Wandsworth Manufacturing Co.	25
Evered & Co., Ltd.	20	Falk, Stadelmann & Co., Ltd.	56
Emanuel & Son	56	Ruskin Pottery Co.	36
Ellis, Simpson & Co.	32		

Belgium.—A new company has lately been formed at Anderlecht (45, Rue Limnander), with a capital of £4,000 and the title La Compagnie des Compteurs Aron.

Stoker Contracts.—Among electrical orders recently booked by The Underfeed Stoker Co., Ltd., are the following:—

Brisbane Trams.—Two Class "E" stokers.
Met. Borough of Stepney.—Eight travelling grate stokers, air heaters, chimneys, &c.
Hanschin Electric Railway.—Eight Class "E" stokers.
Norwich Electric Tramways.—Two Class "E" stokers.
Folkestone Electric Supply Co.—Two Class "E" stokers.

Catalogues and Lists.—Messrs. H. A. Jackson & Co., Caxton Works, Salford.—12-page pamphlet, containing excellent art-printed illustrations, and stating prices, of a number of designs of luminous radiators in hand-beaten art metal. A second pamphlet of 36 pages contains equally good pictures of electric light fittings of fine designs, these including Corona fittings, ceiling plaques, centre fittings, electroliers, pendants, dressing-table fittings, lanterns, &c., in brass and in oxidised, antique or polished copper. Prices are clearly set out.

The Electrical and Engineering Supplies Co., Harold Wood, Essex.—Illustrated and priced leaflet of decorative outfits for Christmas-tree and shop-window decoration and illumination.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Catalogue No. 654 (96 pages), containing detailed descriptive matter, with numerous illustrations, curves and clearly tabulated price information relating to the firm's recording instruments. The list is in three sections, as follow:—(1) Ink recording instruments, with roll chart of 2¾ in. (70 mm.), useful width; (2) ditto, with chart of 4¾ in. (120 mm.), useful width, time recorders; (3) quick-acting recorders, spark recorder and oscillograph, dimension sketches, and general index.

The Electric Battery Co., 62, Eagle Street, High Holborn, London, W.C.—New eight-page list containing a description with illustrations and prices of the "E.B.C." dynamo car-lighting system (S. L. Price's patent).

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—We have been favoured by this firm with a copy of their desk companion for next year. As before, it takes the form of a blotting pad with a reference book at the right-hand side, a calendar for the whole year in monthly squares being arranged along the top of the entire production. Users of previous editions will, in the present instance, find that the squared paper has this time given place to a diary arranged with three days to a page. As before, there are abridged specifications and approximate price lists of the firm's manufactures, together with a number of half-tone illustrations of the works and of the different types of plant made therein. Calendars for both 1914 and 1915 are also given. Nothing more need be added to show the useful nature of this desk companion.

The Electrical Co., 122 and 124, Charing Cross Road, W.C.—Twelve-page price list of novelties in electric signs and illuminations for Christmas. Kaleidoscopic novelties for shop windows, flexible illumination chain for indoor and Christmas tree use, as well as a number of lamps, &c., are listed. Also net price lists of rubber cables, flexible cords and bell wire, and steel conduits and fittings.

The Wagner Electric Manufacturing Co., 15, Clifford's Inn, Temple Bar, London, E.C.—Illustrated and priced leaflet describing the Wagner starter-generator for starting motor-car engines from the driver's seat, and for electrically lighting the car.

The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—List No. 67 describes Cooper Hewitt lamps for the textile trade. A separate pocket booklet of 20 pages gives a lengthy list of shops, works, offices and other premises, &c., where these lamps have been applied, together with extracts from testimonials.

Messrs. Herbert Morris, Ltd., Empress Works, Loughborough.—Bound catalogue, No. 50, of close upon 500 pages entitled "Modern Lifting." The front cover bears a coloured picture of one of their 50-ton, seven-motor electric cranes at work. The book abounds in illustrations, together with brief notes and lists of users, of harbour cranes, electric and hand overhead travelling cranes, electric travelling crabs, crane motors, winches, portable electric haulage gears, jib cranes, conveyors, electric runways, pulley blocks, and so forth.

A series of interesting posters have been issued by the Underground Electric Railway Co. for the month of December which concentrate attention on the Christmas festivities.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, London, E.C.—New 24-page two-colour brochure dealing with the Henley wiring system. It is arranged more particularly for the non-technical man, and to assist contractors in securing customers. It contains a very large number of interesting pictures of premises which have been fitted out on the system. In these illustrations practically every type of property is represented, from Messrs. Brunner, Mond's workmen's dwellings and the small colliery inns of the Newcastle Brewery Co. to fine buildings, such as cathedrals and churches, at home and abroad; St. Wilfrid's College, Oakamoor; Craigdunn Castle, Cullybacky; the Dormy House Club, Brancaster; the Royal Hotel, Whitby; and Halsway Manor, North Devon. Since this booklet was completed, it has been decided to install the Henley system in the workmen's model dwellings now being built on the Duchy of Cornwall Estate, and the work is now in progress.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Folder announcing reduced prices of "Royal Ediswan" drawn-wire lamps.

Norway.—The A/S Elektrokemisk-Industri at Christiania, which company was formed in 1904 for the purpose of promoting electro-chemical, metallurgical and mining enterprises in Norway, at a recent general meeting decided to increase its capital by £111,100 to £333,300. Originally the capital was £111,100, but it has already been increased by a similar amount. During its short existence the company has developed great activity, and already many large electrical concerns have been formed as the result of its operations.

Dinner.—The Western Electric Co.'s inspection department held their fifth annual dinner on Saturday, December 6th, at the Royal Oak Hotel, North Woolwich, close upon 80 of the works inspectors were present. A suitable programme was afterwards rendered. Mr. G. Emes acted as chairman, Mr. R. A. Miles as vice-chairman, and Mr. Charles Read as M.C. The toasts were "The King," "The Company," "The Chairman," and "The Vice-Chairman," all of which were suitably responded to.

A Disclaimer.—Mr. J. MacConnell, director of Premier Electric and Hardware Co., Ltd., 9-10, Cheapside, Golder's Green, N.W., writes as follows:—"My attention has been drawn to the publication in various trade journals of certain legal proceedings affecting a business entitled 'The Premier Electric and Hardware Co.,' of Golder's Green, which may injuriously affect the Premier Electric and Hardware Co., Ltd., of which I am a director. This latter company purchased the goodwill and assets of the Premier Electric and Hardware Co., which was a private business trading under that title, but the limited company has no relationship whatever with that concern; on the contrary, it is a limited liability company registered under the Companies' Acts."

Book Notices. — "The Colliery Manager's Pocket Book, Almanac and Diary." 1914. London: *Colliery Guardian* Co., Ltd. Price 2s. net.

"Rays of Positive Electricity and their Application to Chemical Analyses." By Sir J. J. Thomson. Price 5s. net.

"Photo Electricity." By H. Stanley Allen. Price 7s. 6d. net. 1913. London: Longmans, Green & Co.

"Electrical Engineering." By Clarence V. Christie. 1913. London: Hill Publishing Co. Price 17s. net.

"Science Abstracts." Vol. 16, Part II. Sections A and B. November 27th, 1913. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 8; October, 1913. Chicago: The Society. Price 50 cents.

"*Journal* of the American Institute of Architects." Vol. 1, No. 2. November, 1913. Washington: The Institute. Price 20 cents.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XIII, No. 10. October, 1913. Liége: The Association. Price 5 fr.

Brazilian Patents.—Messrs. Leclerc & Co., of Rio de Janeiro, send us a translation of an ordinance of the Minister of Agriculture, Industry and Commerce, published in the *Diario Official* of October 23rd, 1913, viz.:—"By order of His Excellency the Minister, be it known that, within six months, reckoned from this date, it is exacted that documents, proving the working of the inventions from 1898 to 1911, be filed at this General Direction, in order to be recorded at the respective records, failure to this formality patents will be declared void in pursuance of Article 5, Sec. 2, Nos. 1 and 2 of the Law N 3,129 of October 14th, 1882, in combination with Article 59 of the Regulation approved by Decree N. 8,820 of December 30th, of said year." By what is above stated, say Messrs. Leclerc, it is understood that Brazilian patents not worked in accordance with the law and regulation, will be declared void if the above requirements are not fulfilled.

Dissolutions and Liquidations.—Magneto Exchange and Repairing Co., magneto repairers, 45, Broad Street, Bloomsbury, London, W.C.—Messrs. C. Godfree & O Bartschi have dissolved partnership. Debts will be attended to by Mr. Godfree.

Prested Miners' Gas-Indicating Electric Lamp Co., Ltd., 101A, Elthorne Road, London, N. First meetings of creditors and contributories, December 16th, at 33, Carey Street, W.C.

Bankruptcy Proceedings.—John Samuel Richards, electrician, 29, Frodsham Street, Marfleet, Kingston-upon-Hull.—The public examination of this debtor was held at the Guildhall, Hull, last Monday, when the statement of affairs showed liabilities amounting to £93 and assets estimated to produce £12, leaving a deficiency of £81. The failure was attributed to the law costs of an action brought by him for damages for personal injuries sustained by him in an accident, which action proved unsuccessful. Debtor stated that he was a journeyman electrician, earning 37s. a week. The examination was closed.

W. H. Davis (lately trading as the General Incandescent Fittings Co.), dealer in gas and electric light accessories, 75, Ralph Road, Saltley, Birmingham.—The public examination of the above debtor was held last week at Birmingham. The case was declared closed.

Trade Announcements.—We understand that Messrs. Williams & Bach, of 9, Hanover Street, London, W., have acquired the services of Mr. William E. Gallier, and he has resigned his position with Messrs. Jackson & Boyce, of Berners Street.

The business of the United Lamp Co. was, on November 30th, transferred to the Imperial United Lamp Co., Ltd., of Caxton House, Westminster, S.W.

Mr. R. C. Baines, who has held several important positions in India, amongst others that of electrical engineer to the East India Railway, and latterly with the General Electric Co., of England, has joined Messrs. Lester B. Betts & Co., Ltd., of 9, London Street, E.C., as a director. Messrs. Lester B. Betts & Co., Ltd., represent, amongst others, a large number of electrical manufacturers for export.

Messrs. Krupka & Jacoby, Ltd., announce that they have appointed Messrs. Andrews & Co., of 198A, St. Vincent Street, Glasgow, as their agents in Scotland.

Showroom premises and offices have been opened at 11, Queen Street, Exeter, by Messrs. Brooking & Co., electrical engineers, which firm has been joined by Mr. W. Bird, of Dawlish.

Electric Signs.—The Sun Electrical Co., Ltd., of Charing Cross Road, W.C., have sent us a night view showing a Sun electric sign which has recently been erected on the Elephant and Castle Hotel. This is one of two recently erected for Sandow's Cocoa Co., the other being fixed on the top of the dome of the Angel at Islington. It goes without saying that both signs are excellent advertisements for this particular cocoa, and it is interesting to note that, though so far apart, either sign is visible from the other. Each of the signs contains just over 300 lamps, and the letters are 2 ft. 9 in. high.

Christmas Publicity.—The Electric Supply Publicity Committee, of 20A, Tudor Street, London, E.C., have issued a booklet of 16 pages, containing some notes on, and small illustrations of, electrical apparatus suitable for Christmas presents. The pamphlet has been issued for the use of the supply companies and local authorities.

For Sale.—York Corporation has for sale four 75-kw. compound Willans-Crompton sets, and three 27-h.p. electric capstans, &c. By tender, the whole business of Messrs. Warren, Beattie & Co., Ltd., Electrical Engineering Works and Stores, Middlesbrough. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Abercarn.—The B. of T. has revoked the 1906 E.L. order.

Accrington.—It was announced at the T.C. meeting last week that if Great Harwood decided to take electricity from Accrington, as far as could be seen, it would not add to the plant required, as the demand would come on at half-past five, and could then be satisfied very easily.

Arder (Co. Louth).—E.L. Scheme.—A special meeting of the Town Commissioners has been summoned to consider a proposal made by Messrs. Cooke & Byrne that in the event of the Commissioners obtaining sanction for the electric lighting of the town, the firm will be prepared to find the capital for carrying out the scheme.

Argentina.—At a public meeting of the inhabitants of Tres Arroyos a co-operative association was formed for the installation of electric light in that town.

The Cordoba Government has granted a concession to Sr. D. Baravalle to establish an electric light station in Las Varillas department of San Justo.—*Review of the River Plate.*

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Australia.—The Treasurer of the South Australian Government recently announced that a Royal Commission to inquire into the gas and electric supply services would be appointed at the end of the present session of Parliament.

The Newcastle (N.S.W.) Municipal Council has obtained a loan of £5,000 for the purpose of extending the electric lighting scheme.

THE PERTH (W.A.) MUDDLE.—A late issue of the *Commonwealth Engineer* discloses a strange position of affairs in connection with the Perth electricity supply, which, to put it mildly, reflects little credit on the municipal and other authorities concerned. It will be remembered that the city bought out the Gas and Electric Co some time ago; before its new owners took possession, the State Government decided to resume certain land on which stood the electricity works, and consequently the city called in its expert, Mr. Edmiston, who advised the building of a new A.C. station, and abandonment of the existing D.C. distribution system. The Council was divided on the proposal, and subsequently a report was obtained from Mr. Broadbent, the company's engineer, which emphatically opposed the supersession of the D C. distribution, while agreeing to the necessity of a new power station. This idea found favour, but in order to decide the matter, Mr. Forbes Mackay was called in, and he pronounced in favour of the first proposal.

In the meantime the city was negotiating for the purchase of the Perth tramways, but a favourable offer was, due to the indecision of the Council, allowed to pass, and as there seemed no prospect of finality, the State Government stepped in and purchased the concern at a much higher price. In planning improvements to the system, the Government came to the conclusion that as a new tramway power house would be required, this might also serve for the city supply.

Other matters had arisen also in connection with the appointment of city engineer, which had been given to Mr. Broadbent, and an appeal to Mr. Forbes Mackay resulted in that gentlemen recommending that the matter be placed in the hands of Messrs. Merz & McLellan.

In meantime nothing definite appears to have been done, but the services of three more local experts were obtained to report jointly on the position and apparently favoured the original Edmiston proposals.

At this time the Government, after conferring with Mr. Merz, decided to undertake the whole electric supply to Perth and suburbs from its power station, offering a supply to the city at ¼d. per unit, and leaving the city to distribute the energy.

An agreement appeared to have been reached, but legal difficulties occurred relating to the right of the city to supply in the suburbs, which delayed matters another five months. Now the suburbs claim the privilege of dealing direct with the Government. Under these conditions the city engineer considers that the old plant will suffice for its needs.

The net result, according to our contemporary, is that the city has lost the electricity supply, and finds itself saddled with a debt of nearly half a million, and, by its stupidity in handling the matter, has its source of revenue very much curtailed. A further trouble is that Messrs. Mertz & McLellan have ordered the new Government plant for a 40-cycle frequency, while that in use at the railway workshops, at the Fremantle Harbour works and at the town of Fremantle is of 50 cycles. This will result in loss in conversion either of energy or plant, and, moreover, it appears that the Fremantle Tramway Board can supply itself at a less cost than the new Government supply.

THE SHOALHAVEN SCHEME.—The report of the chief electrical engineer of Goulburn on the practicability of obtaining power from the Shoalhaven River states that a dam immediately below Warri Bridge appears the most suitable. Pipes would be led a distance of 35 chains to the power station, giving a total head of 1,010 ft. This would supply 10,000 H.P., and if necessary 30,000 H.P. Including a transmission line to the proposed State power scheme at Kiama, the cost is estimated at £526,000. The report states that the tin manufactures alone would justify the scheme. The charge per unit is estimated at an average of 0·43d.

Batley.—NEW TURBINE PLANT.—At the last meeting of the T.C. consideration was given to a recommendation of the Electricity Committee that the Committee should be authorised to enter into a contract for the installation of a 1,200-KW. Ljungstrom turbo-generator (or in the alternative a 1,000-KW. "disc and drum" turbo-generator) with other plant and auxiliaries. It was explained by Mr. J. W. Turner that the additional plant was required owing to the increased demand for current. The recommendation of the Committee was approved unanimously

The tradesmen have decided to adopt a scheme of electrical illumination in Commercial Street for Christmas.

The Yorkshire Electric Power Co., which has the right to supply electricity for power purposes in Soothill Upper, is seeking powers to supply current there for lighting also.

Battle.—WORKHOUSE INSTALLATION.—The B. of G. last week inaugurated the E.L. installation at the Workhouse. The installation has been carried out by Messrs. J. L. French & Co., of Bexhill, at a cost of £319, and replaces oil lamps. There are nearly 140 lights, and current at 50 volts is supplied by a dynamo, driven by an Aster engine. The storage battery, having a capacity of 300 ampere-hours, is by the Chloride Co., Ltd. Mr. A. C. Ticehurst, of the Bexhill E.L. Works, acted as consulting engineer to the board.

Bawtry (near Doncaster).—E.L. PROPOSAL.—The P.C. has passed a resolution in favour of the scheme submitted by Messrs. Best & Pullan for supplying electric light to the town. It is intended to hold a parish meeting, and Messrs. Best & Pullen are to be requested to attend and explain their proposals.

Bitterne.—PROPOSED E.L. SCHEME.—The Southampton T.C. has offered to extend the E.L. mains to the parish at an estimated cost of £681, to charge the P.C. £2 9s. 6d. per lamp per annum for public lighting with a minimum of 35 lamps, and to supply current for private lighting at 4d. per unit.

Beckenham.—Having made arrangements to supply electricity to the factories of Messrs. Muirhead and the British Radium Corporation, at Elmers End, the U.D.C. has decided, with a view to other consumers being connected later on, to lay high and low-tension cables and erect sub-stations at an estimated cost of £1,200.

Blackrock (Co. Dublin).—The U.D.C. has adopted the report of the Electric Lighting Committee on the negotiations conducted by the Council with regard to the various lighting projects before the Council. It was stated that the Alliance Gas Co. had failed to obtain a prov. order, and had published notice of its intention to promote a Bill in the next session for powers to supply electricity to Kingstown, Blackrock and Dalky, and the Committee recommended that in the meantime no action should be taken beyond getting the Council's electric lighting order renewed.

Bradford-on-Avon.— PROPOSED E.L. SCHEME.—Mr. J. H. Edwards, of Bristol, who is applying for a prov. order for E.L. within the urban area, has informed the R.D.C. that it is proposed to include certain rural parishes in the area of supply, and asking if the Council has any objection to the proposal. The Council has requested full details of the proposals for consideration.

Bocking (Essex).—PROPOSED E.L. SCHEME.—The P.C. on December 1st, discussed the E.L. question, and had before it two schemes, one requiring a capital expenditure of £2,700, and an annual cost of £200, and the other a capital outlay of £2,000, and a yearly cost of £175. It was decided to invite electrical companies to consider the possibility of electric lighting in the parish.

Braintree.—PROPOSED E.L. SCHEME.— With a view to carrying out an E.L. scheme for the town, the U.D.C. has appointed a deputation to visit the works of the Grays U.D.C. and obtain information of the undertaking there.

Bridlington.—PUBLIC LIGHTING.—The T.C. has instructed the borough electrical engineer to report upon the cost of laying cable for the full length of the Sewerby sea defence road and in the streets on the Lamplugh Estate, and also on the cost of erecting public lamps at those places.

Canada.—Electric cooking is finding much favour in Victoria, B.C., and at the present time some 300 installations are in operation, giving entire satisfaction. The B. C. Electric Co. gives a special rate of 5 cents per KW.-hour for heating and cooking business, subject to a monthly minimum charge of 75 cents per connected KW.; with this rate there has been no complaint, and this end of the company's business is steadily increasing, the average connections during the past six months being three ranges per week. One installation, which has proved to be of more than ordinary advertising worth, was a complete electrical installation in one of the local schools, in the Household Science Department. Parents of the girls have an opportunity to visit the classes at any time to note progress made, and the electrical equipment has invariably come in for special attention. Ninety-eight per cent. of the residences in Victoria are connected to the electric system; 10,000 lighting meters are in use, with a population of 60,000.—*Journal of Electricity, Power and Gas.*

Our Ottawa correspondent says the chances are in favour of the Toronto Hydro-electric Commissioners purchasing the Toronto Electric Light Co., while the purchase of the Toronto Electric Railway is also urged.

It is proposed by the Ottawa municipal electrical authorities to reduce the present rate of 3 cents per KW.-hour for heating to 2 cents; also, in the case of the "house-area" rate (consisting of a fixed rate plus 3 cents per KW.-hour for current), a discount of rather less than 50 per cent. is proposed on the metered supply. This, it is considered, will greatly assist in developing electric cooking and heating. The proposed reduction will also affect the rates of the Ottawa Electric Co.

The Ottawa municipal electricity department has been notified by the Ontario Hydro-Electric Commission that a reduction of its light and power rates by 10 and 15 per cent. respectively is authorised. This is practically an order from the Commission, which the municipal department is prepared to agree to. A similar reduction is authorised for Toronto and London.

Everyone of the 46 municipalities in Ontario using hydro-electric energy, earned a surplus for the last nine months. These surpluses varied from 56 to 10 per cent.

Carlisle.—NEW LOANS FOR PLANT.—The Electricity Committee has agreed to apply to the L.G.B. for sanction to borrow £23,440 for extensions and the provision of new plant at the electricity works.

Chesterfield.—L.G.B. INQUIRY.—An inquiry was held last week into the application of the T.C. for a loan of £7,000 for electricity purposes, £4,000 being for mains, £2,500 for high-tension transforming and transmission lines, and £500 for spares. There was no opposition.

Connah's Quay.—E.L. REPORT.—The U.D.C. has had prepared, by Mr. A. Leigh, a report on the question of electric lighting, and this is being considered by a Special Committee, which will report later on.

Coniston.—E.L. SCHEME.—At a meeting of the P.C. it was reported that the proposed electric lighting scheme for the district had been favourably considered by the Divisional Committee and the R.D.C.

Continental Notes.—NORWAY.—At one of the last meetings of the Municipality of Hangesumd, it was unanimously decided to acquire the Rödne Waterfall. The Rödnefos is situated 30 miles from the town, and it is estimated that the whole scheme, including the erection of a secondary power station and the transmissions, will involve a capital expenditure of about £72,300.

AUSTRIA.—A generating station for the supply of current for lighting and power purposes in connection with its various collieries has just been completed near the Franz Colliery by the Kaiser Ferdinand's Nord Railway. The plant comprises four 3,000-H.P. steam turbines and generators.

ITALY.—It is reported from Rome that a German company has applied for a concession to utilise the water power of the River Piave, near Soccher, in the generation of electricity for lighting and power purposes. The plant, &c., is estimated to cost about £2,800,000, and 165,000 H.P. is available.

PORTUGAL.—A concession has been granted to the Serra da Estrela Hydro-Electric Co. for the supply of electric power for the public and private requirements of the Town of Mangualde. The concession is for a term of 20 years.—*Board of Trade Journal.*

Dewsbury.—SCHOOL LIGHTING.—At the last meeting of the B.C., it was reported that the Electricity and Tramways Committee had been in communication with the Education Committee, with regard to the lighting of various elementary schools with electricity. The Education Committee thought that the charges proposed were excessive and asked for more favourable terms, the Electricity Committee replying that it was prepared to lay cables to all the Council schools within the borough, with the exception of the Knowles Hill Road School, without the usual guarantee. This offer is being considered by the Education Committee.

Dublin.—At the quarterly meeting of the Retail Traders' Protection Association a resolution was adopted urging consideration of the advisability of removing the increase of 10 per cent. made on electric light charges in the city some years ago.

Dundee.—THE BROUGHTY FERRY REPORT.—The electrical engineer's report upon the condition of the plant in the Broughty Ferry power station, was under discussion at the last Council meeting, and provided the recently-elected Ferry members with an opportunity for some plain speaking.

Mr. W. Anderson moved that the report be not adopted, and that it be sent back to the engineer with a request that he furnish a report upon the actual cause of the breakdown. He also suggested that a committee be appointed to invite the criticisms of the late manager at Broughty Ferry, or those who were associated with him prior to Dundee taking over the working of the station, in order that the whole facts of the case might be elucidated.

Another member stated that the storage battery mentioned by the engineer had been examined four months ago in Mr. Richardson's presence, when he was told it was useless, and that upon their proposing to spend £200 upon it, Mr. Richardson had advised them not to spend anything.

Against this, however, it was stated that Mr. Richardson had reported to the Broughty Ferry T.C. that unless it carried out certain repairs, estimated to cost £500, he would not be responsible for any breakdown that would occur.

The Council replied that there was no use spending the money seeing that Dundee was to take it over. The convener mentioned that the actual cause of the stoppage was a failure of the feed pump, when it was found that a reserve pump was also useless.

After further discussion, it was moved as an amendment that the report be approved, and this became the finding of the meeting by 24 votes to 7.

In connection with the foregoing, a lengthy letter has been addressed to the late convener of the Electricity Committee of the Broughty Ferry T.C. by Mr. James L. Turnbull, the late engineer and manager of the power station. Mr. Turnbull takes up the Dundee electrical engineer's report piecemeal, seeking to show that at the time the station was handed over, the plant was in as good a state of efficiency as was possible for plant of its age to be. He also pointed out that Mr. Richardson had been informed in September that certain renewals and repairs were necessary, but that he objected as the whole place was to be scrapped.

In conclusion, Mr. Turnbull said the breakdown would not have occurred if the Broughty Ferry staff alone had been in charge of the plant.

Easingwold.—PROPOSED E.L. SCHEME.—The R.D.C. has informed Mr. Chas. H. Best, of Bradford, that it views with satisfaction the proposed formation of a company to provide electricity for the parish, and would confer with the representatives of the company on the matter.

East Ham.—The Electric Lighting Committee recommends that as from April last the price of electricity supplied to the tramways be reduced from 1·125d. to 1·0625d. per unit. The engineer and manager has suggested that the current for power and heating, now charged at the rate of 2d. per unit, should be reduced to 1½d., subject, in the case of power, to a minimum account of 3s. per quarter, and in the case of electric radiators to a minimum account of 12s. per annum. The Council has accepted a tender for the supply and fixing of two automatic stokers at the generating station.

Eastleigh.—The U.D.C. has decided not to agree to the terms of the Southampton Corporation for a supply of electricity.

German East Africa.—A concession has recently been granted to put down a plant to utilise the water power of the Pangani waterfall at Usambaraj for the generation of electrical energy.

Grantham.—WORKHOUSE LIGHTING.—The B. of G. has decided to have the question of lighting the workhouse inquired into, and to have terms for electric lighting submitted.

Hastings.—PUBLIC LIGHTING, &C.—The T.C. on December 5th decided to extend the mains, at a cost of £500, to supply current to "Beaulieu," Ore, and advantage will be taken of the service to convert the street gas lamps *en route* to electricity.

Hazel Grove-cum-Bramhall.—The U.D.C., which is applying for a prov. order for E.L., has retained Mr. H. C. Crews as consulting engineer.

Hereford.—The T.C. has sealed an agreement for the supply of electricity for lighting and power to the premises of the Hereford Society for Aiding the Industrious.

Hindley.—L.G.B. INQUIRY.—Mr. H. R. Hooper conducted an inquiry on December 3rd into the application of the U.D.C. for sanction to borrow £2,500 for the purpose of electric lighting. There was no opposition. Mr. T. Robey said the Council made an agreement with the Lancs. E.P. Co. in 1907 for a supply of electricity in bulk, and it was now in the position that if it did not carry out the order, the B. of T. would revoke the order. Applications kept coming in, and the Council had great hopes that within a very short time the demand would be very satisfactory. Upon the suggestion of the Inspector, who pointed out that the £2,500 asked for allowed nothing for small extensions, it was agreed to consider the raising of the sum from £2,500 to £3,100.

Holmfirth.—NEW LOANS.—The D.C. has decided to apply to the L.G.B., for sanction to borrow £7,500 for the purpose of the electricity undertaking, the money being required for generating plant, &c. The extensions will, it is believed, necessitate the erection of additions to the electricity works.

Huddersfield.—L.G.B. INQUIRY.—An inquiry was held last week by Mr. H. R. Hooper into the application of the Corporation for powers to borrow £60,000 for the electricity undertaking. The town clerk said the money was required for generating plant, additional boilers, additions to switchboard, and extension of mains to enable the Corporation to meet the increasing demands for current, both for power and lighting purposes. He pointed out that the capital expenditure on the undertaking in 1912 was £240,155; the number of consumers was 4,705; the units sold in 1912 were 7,129,987, and the revenue had increased to £45,078 last year. The borough electrical engineer said that the Corporation proposed to install at once a 4,000-KW. three-phase set, and to add, two years hence, a 2,000-KW. single-phase set. After that it would gradually convert the single-phase system into a three-phase installation. The estimated cost of the new plant was £35,500; new mains £21,500; total £52,000; leaving £8,000 for future use. There was no opposition.

Hyde.—PUBLIC LIGHTING.—The Hyde Tradesmen's Association has decided to approach the Corporation with a request that it should light the principal thoroughfares with electricity, and thus encourage its own undertaking.

Irvine.—PROPOSED E.L. SCHEME.—The T.C. has appointed a Committee to negotiate for a supply of electricity from Kilmarnock.

Japan.—According to a report recently issued by the Japanese Ministry of Finance, there were 155 electric light undertakings in Japan at the end of 1911, supplying current to an equivalent of 2,761,000 lamps, as against 122 undertakings and 1,902,000 lamps respectively at the end of 1910.

According to the *Financial Times*, the proposed Tokyo loan for £1,600,000 for electrical works has been officially sanctioned, and it is considered probable, therefore, that a foreign loan will be floated in the coming spring.

Keighley.—LOANS FOR PLANT EXTENSIONS.—The Electricity Committee of the T.C. has decided to apply to the L.G.B. for the following loans:—£1,200 for building extensions; £400 for a 25-ton crane and extension of gantry; £2,500 for 800-KW. converting plant and switchgear; £6,000 for two water-tube boilers, with chain grate stokers, ash handling plant, and economiser tubes and flues; and £6,000 for mains.

Kirkburton (near Huddersfield).—PROV. ORDER.—The U.D.C. has agreed to support the application of the Yorkshire Electric Power Co. for powers to supply electricity for lighting purposes within its district.

Knaresborough.—THE E.L. SCHEME.—A special meeting of the U.D.C. is to be held at an early date to consider the report of Mr. Wilkinson upon the possibilities of an electric lighting scheme, estimated to cost £4,000.

Knottingley.—E.L. SCHEME APPROVED.—At a special meeting of the U.D.C. last week, the scheme submitted by Mr. J. W. Speight for the lighting of the town by electricity was approved. The Committee which had had the matter under consideration had come to the conclusion that by the adoption of electricity better light would be given than at present, and it would be more economical to install electrical plant than to replace the present pumps at the sewage works.

Littleborough.—L.G.B. INQUIRY.—An inquiry was held last week into the Council's application for sanction to loans of £4,000 for electrical purposes. Energy is purchased from the Rochdale T.C. at 10 per cent. additional to its works costs. There was no opposition to the proposal.

Llanfairfechan.—E.L. SCHEME.—At a meeting of the local Council, last week, a communication was read from a Manchester firm of electrical engineers, in which they guaranteed, for an outlay of £3,500, to install plant to supply 100,000 units per annum, at a cost of 3·8d. per unit; and that for an outlay of £5,250 they would guarantee a supply of 250,000 units annually, at a lower cost still. They would prepare full details of the scheme proposed for a fee of 10 guineas, and in the event of it not being proved to be practicable, would waive their charge. The matter is under consideration.

London.—MARYLEBONE.—The B. of G., at its last meeting, considered recommendations that information be obtained from the Notting Hill E.S. Co. as to the cost of a supply of current for lighting and other purposes to the infirmary at Notting Hill; and that the Finance Committee be requested to advise the Board whether current should be generated at the infirmary. Dealing with the first recommendation, Mr. Dennis proposed that the B.C. should be asked to allow its electrical engineer to give expert advice, and assist the Guardians in carrying out the scheme. This was agreed to. In the discussion which ensued on the second recommendation, Mr. Elmer said that if private companies could generate current and make profits, the B. of G. could make it cheaper for its own institutions. At present the cost of gas at the infirmary was enormous, and if, by installing electricity, the lighting bill could be reduced by £750 per annum, the matter should be seriously considered. It was decided to approve the recommendations. At the same meeting it was stated that owing to the installation of metallic-filament lamps and certain alterations in the lighting arrangements at the workhouse, the lighting bill had, in six weeks, been reduced £20.

L.C.C. LOANS.—The Finance Committee has recommended the Council to sanction the borrowing by the Battersea B.C. of £4,500 for the electricity undertaking—£3,250 for mains, £480 for services, and £770 for meters.

Manchester.—The seal of the Council has been placed to an agreement with the Trafford Power and Light Supply (1902), Ltd., for the purchase and transfer of that undertaking to the Corporation.

The Electricity Committee has approved a report of the engineer, recommending the adoption of an inclusive charge per annum for providing and maintaining arc lamps for outside shop-front lighting.

Malvern.—At a meeting of U.D.C. the electrical engineer was instructed to prepare a report on the present capacity of the electricity works and the extensions necessary for future supply.

Newcastle-on-Tyne.—At a meeting of the electrical section of the Chamber of Commerce, on the 8th inst., Mr. F. O. Hunt presiding, a discussion took place on the new Electric Lighting Bill, which, it is understood, will be promoted in Parliament next Session, and it was resolved that opposition should be made to the clauses conferring on municipalities power to make installations and also to act as retail traders in electrical fittings. A discussion also took place on the classification of railway rates for electrical apparatus. It was resolved that a report be presented at the next meeting of the Committee.

An agreement has been sealed by the Corporation with regard to the supply of electricity for the purpose of pumping water from the Charlotte Pit, Benwell. The T.C. will receive £420 per year for seven years towards the cost of the cables, and about cost price for the electricity consumed.

Newcastle (Staffs.).—The T.C. has reduced the price of electricity for power purposes to 2d. per unit for the first 5,000 units per annum.

Oldcastle.—A public meeting having decided in favour of electric lighting in the town, the L.G.B. is to be asked to hold an inquiry as to powers to carry out a scheme.

Penmaenmawr.—The Council has decided to ask the North Wales E.P. Co. for its terms for supplying the town with electric lighting.

Prestatyn.—The L. & N.W. Railway Co. has applied to the Rhyl Council for a supply of E.L. to the new station at Prestatyn.

Rochdale.—PROPOSED LOAN.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £1,359 for electricity purposes.

Rotherham.—The T.C. has appointed a sub-committee to consider a report prepared by the engineer with regard to the installation of additional plant and an extension of the buildings at the electric light station.

Sale.—PROPOSED LOAN.—Application is to be made by the Council to the L.G.B. for sanction to a loan to enable it to install a new and larger storage battery and booster.

Settle.—PROPOSED E.L. SCHEME.—At the last meeting of the P.C., a communication was read from a Bradford firm with reference to the suggested formation of a local company for supplying electricity in the town. The promoters suggested that the capital of the concern should be £2,500. In addition to supplying Settle the company would also be able to supply the districts of Langcliffe, Giggleswick and Stackhouse. The directors of the company will be advised that they can profitably tender for the street lighting at 25s. 6d. per 32-C.P. lamp per annum, lighted five hours per day for eight months per year. It was ultimately decided to call a ratepayers' meeting in January next to consider the matter.

Sheffield.—LOANS SANCTIONED.—Sanction has been received from the L.G.B. to the borrowing of the following amounts for the electricity undertaking: £2,800 for cooling towers, £4,700 for pumps, pipes, &c., and £4,800 for concrete tanks, foundations, &c. The general manager estimates a surplus of £12,154 on the working of the undertaking during the year ending March 25th, 1914.

South Africa.—In order to popularise the use of electricity for cooking and heating purposes, a new scale of charges has been adopted by the Cape Town T.C. The new terms are that an average of the consumer's consumption in any given house for lighting for the last 12 months of full occupation be obtained, such average, plus 10 per cent., being fixed as the number of units that such consumer must pay for per month at the current tariff for night lighting (7d.); consumption above this quantity to be charged at 2d. per unit for the first 100 units, 1½d. for the next 200 units, and above 300 units per month 1d. per unit. The minimum charge under this system is to be 10s. per month; and in the case of new consumers, the city electrical engineer is to fix the number of units which the consumer must pay for per month at current tariff for night lighting. It will be noticed that the use of an additional meter is obviated.

A very severe thunderstorm recently passed over Pilgrim's Rest (Transvaal), and struck the generating station of the Central Mine (Transvaal Gold Mining Estates). The building was immediately enveloped in flames, and the whole plant and buildings were completely destroyed, as when the company's employés arrived on the scene, it was impossible to arrest the progress of the conflagration. The plant was the first large electric haulage erected in South Africa.

The East London T.C. is raising loans, including £13,000 for electric lighting and tramways purposes.

The Cradock (Cape) Council is to spend £10,000 on electric supply, and the Prince Albert (Cape) Council is raising a similar sum partly for the same purpose.

Stone (Staffs.).—PROV. ORDER, &C.—With reference to the application of the Gas. Co. for powers to supply electricity in the district, the U.D.C. has decided to obtain a copy of the company's Bill, which the clerk will consider and report upon. The opinion is that the Bill should be opposed on the ground that electricity should be provided, if necessary, by the Council.

St. Helens.—The Corporation Electricity Committee has granted the following discounts to large consumers for lighting: From 4,500 units to 6,000 units per annum, 10 per cent.; 6,000 to 7,500, 15 per cent.; beyond, 20 per cent.

Stretford.—The Electricity Committee has decided to reappoint Mr. T. L. Miller as consulting engineer to the Council. Experiments are to be made in the conversion of flame arc lights to "cluster" lights for public lighting.

Swinton and Pendlebury.—PUBLIC LIGHTING.—The U.D.C. is considering a scheme for substituting electricity for gas lighting on the main roads, at an estimated capital outlay of £1,600.

Teignmouth.—E.L. SCHEME.—At a public meeting held last week, a resolution was carried declaring that if the U.D.C. was not in a position at present to undertake an electric lighting scheme, the Council should favour the electric lighting being undertaken by a company.

The U.D.C. has refused Mr. F. W. Warren permission to erect overhead wires for the transmission of electricity from the premises of Mr. W. T. Welch to the proposed new premises of the National and Provincial Bank, Ltd.

Torpoint.—PUBLIC LIGHTING.—The U.D.C. has accepted the tender of the proposed local electric light company for street lighting at £2 14s. per 75-C.P. lamp. A penalty of £50 to be imposed if the company was not ready to supply by May 1st, 1914, was inserted in the contract.

Trimdon (Co. Durham).—A special meeting of the P.C. has been held for the purpose of considering the lighting of Trimdon Grange and Trimdon Colliery with electricity. The manager of the electric supply company is to be interviewed on the matter.

U.S.A.—An electric signboard, 48 ft. high, and containing 32,000 lamps, is to be placed on the roof of the Josse Building, San Diego; it is said that it will be the largest electric sign in Southern California.

Walsall.—The Corporation Electricity Committee's recommendation that the price of electricity for purposes other than lighting and traction should be increased 20 per cent. has been adopted by the T.C. The Committee has again had under consideration the question of popularising the use of electricity by the hiring out of motors, cookers, and other appliances, but at present it cannot see its way to recommend the Council to incur the capital expenditure that would be required.

Watford.—The Electric Lighting Committee has approved an offer by the electrical engineer for lighting the Council's houses now in course of erection. The engineer proposes to charge £10 per KW. of maximum lighting demand (such charge determined by the use of current limiters in each house), and a secondary charge of ¾d. per unit for all energy consumed (this charge to be determined by one main meter serving the whole block of houses). The initial cost of wiring the 12 houses is put at £36. The offer has been accepted.

West Ham.—NEW LOANS, &c.—The Electric Lighting Committee reports having had before it a question raised by the electrical engineer with regard to an invention for improvements in electrical apparatus designed by a member of his staff, who desired to protect it. On the undertaking that the inventor derives no pecuniary benefit either directly or indirectly from the purchase of the apparatus by the Council so long as he remains in the Council's service, the Committee has decided to allow him to protect the invention. This arrangement is to apply in any similar case in the future.

Application is to be made to the L.G.B. for permission to increase the Council's previous application to borrow £9,000 for transformers, &c., and £8,500 for mains extensions, to £13,500 and £12,750 respectively.

West Lancashire.—The West Lancashire R.D.C. on December 4th decided that in view of the Leyland Electrical Co. seeking for a prov. order to put down plant sufficiently large to supply the needs of certain parishes in the West Lancashire area, the clerk be authorised to take such steps as will protect the interests of the portion of the West Lancashire area which may be affected. Hesketh Bank and Tarleton are the places it is desired to protect.

West Yorkshire Rural Lighting.—The Halifax R.D.C. has decided to support the application of the Yorkshire Electric Power Co. for powers to supply electric light in districts at present without a supply.

The R.D.C. also appointed the Upper Greetland Parochial Committee to meet the company at Thornhill to discuss the question of lighting Upper Greetland by electricity.

Wigan.—LOANS SANCTIONED.—The L.G.B. has sanctioned the borrowing, by the E.L. Committee, of £7,500 and £200 for a new turbo-alternator and accessories respectively.

Wrexham.—Permission has been granted to the T.C. to extend its mains to the garden village of Acton for the purpose of lighting the latter by electricity.

TRAMWAY and RAILWAY NOTES.

Burnley.—TRAMWAY EXTENSIONS.—Tramway extensions formed the subject of a report brought before the T.C. on December 3rd. The extensions are proposed to serve the Abel Street, Stoneyholme, and Brunshaw districts. Two schemes are suggested, the first estimated at £61,500, and the second at £29,130.

The Tramways Committee has received a letter from the B. of T. sanctioning the running of a goods wagon on the tramways for an indefinite period, subject to a speed condition, and on the understanding that it may at any time be prohibited if that is considered necessary by the Board.

Canada.—There are now nearly 40 electric industrial motor vehicles in service in the City of Winnipeg, where every facility for the charging of such machines is afforded by the electric lighting and tramway authorities. In the case of contracts, the rate for energy for battery charging is ¾d. per KW.-hour.

Dearne Valley.—E.L. SCHEME.—The promoters of the tramway scheme for the Dearne Valley are seeking extensive powers for electric lighting in the district, including part of Barnsley, eight urban districts and two rural parishes.

Continental Notes.—SWITZERLAND.—The Standing Committee of the management of the Swiss Federal Railways recently considered the question of the electrification of the Erstfeld-Bellinzona section. It was decided to throw open to public tender the constructional works, although part would be carried out departmentally. The supply of energy would not, however, be called for, but it was decided that the Federal Railways should build their own hydro-electric stations. The reason for this step lay in the opinion that, were supplies obtained from private companies, the latter would form themselves into a trust, and dictate prices to the Railway Administration, and allusion was made, in this connection, to the danger of large foreign bulk undertakings (by which were meant, no doubt, German companies) acquiring a preponderating interest in the share capital of such companies as formed the trust.—*Elektrotechnische Nachrichten.*

AUSTRIA.—The Dux Bodenbach Railway has contracted to supply the Karlsbad T.C. with electricity for 25 years, from a power station at the Kaiser Colliery, which it owns.

ITALY.—According to the *Giornale dei Lavori Pubblici*, the extensive tramway scheme for the province of Cuneo is held up for the present.

Three sections of tramways of 280, 115 and 85 km., joining certain prominent towns, were proposed. The tramways would be subsidised by the various communities interested.

BULGARIA.—A scheme is at present under consideration for the construction of an electric tramway between Sofia and Banki.

FRANCE.—The tramway line between Chambery and Le Bourget was carried away by a storm last week. The railway and telegraph poles also suffered.

East Ham.—Barking U.D.C. has given the T.C. six months' notice to terminate the arrangement now in force between Barking, the L.C.C. and the East and West Ham Corporations with respect to inter-running of the tramcars of each authority between Aldgate and Loxford Bridge.

Glasgow.—The T.C. this week granted conditional consent to a prov. order in the next Parliamentary session for about 20 miles of double-track tramways. There are some short extensions within the city proper, but the larger extensions are from the city boundaries through the more distant suburbs into adjacent towns, including Milngavie and Coatbridge. Negotiations have been in progress for some months, and while the outcome of these has not been made public, the convener of the Tramways Committee assured the T.C. on Monday that unless satisfactory arrangements were made with the county and other local authorities interested, the Committee would not propose proceeding with the extensions.

At the same meeting the T.C. decided to seek powers for the construction of a bridge over the river to link up Oswald Street and Commerce Street, to carry a section of the north and south tramway traffic and relieve Glasgow Bridge.

Grimsby.—An accident occurred last week on the Grimsby and District Electric Railway running to Immingham, to the centre of the new dock area, due to a collision between two cars. Although the cars were badly damaged, those travelling on them, with the exception of a conductor, who was cut by glass, escaped injury.

Leeds.—RAILLESS TRACTION SCHEMES.—At a meeting of the City Council on December 3rd, the tramway clauses in the Corporation's Bill were approved. They embody various extensions, and the running of a service of railless cars from Menston to Burley, and from Menston to Otley, in Wharfedale, and it was stated by Alderman Wilson that these were the only routes the Tramways Committee had in mind at present, though, should additional powers be secured, the Committee would consider the advisability of inaugurating further routes.

Leigh.—The chairman of the Tramways and Electricity Committee has presented a report to the General Purposes Committee containing information from other towns with respect to the running of motor-'buses and railless trolley cars, and also two schemes of running similar 'buses and cars in Leigh. Consideration of the report has been deferred.

Lincoln.—The T.C. on December 2nd, by 15 votes to 5, rejected a proposal in favour of the Sunday running of the cars.

Liverpool.—Alderman Smith, at a recent meeting of the Tramways Committee, said the Council intended to spend £13,000 or £14,000 in trying motor-'buses for linking up certain tramways and testing districts where tramways were being asked for.

London.—According to the *Standard* a proposal for "express" tramcars for the suburbs is being considered by the Highways Committee of the L.C.C. The idea is that, instead of every car stopping at every halt along the line, in the outer area certain cars should only stop at important points. This would mean a considerable speeding-up of tramway traffic. At present the rate of travelling is on an average nine miles an hour.

AN EDISON 'BUS.—It is reported that the London General Omnibus Co. is building an electric motor-'bus at its works at Walthamstow to the order of the Edison Battery Co.

THE L.C.C. AMBULANCE SCHEME.—At the meeting of the L.C.C. on Tuesday, the chairman of the General Purposes Committee said the Committee could not recommend the Council to adopt the ambulance scheme of the Metropolitan Asylums Board. A sub-Committee has been appointed, and it is hoped that a scheme will be placed before the Council next week.

Manchester.—Additional Cars.—Instructions have been given for the building at the works of the Tramways Department of 25 additional car-bodies of the bogie type.

Newcastle-on-Tyne. — At a meeting of the City Council, on the 3rd inst., it was decided to promote a Bill to sanction extensions of the tramways in the area of the Longbenton U.D.C. The capital expenditure is estimated as follows:—Tramways construction, £51,150; sub-stations, £4,400; 12 motor-'buses, £9,600; total, £65,150.

Poole.—Railless Traction Scheme. — The Sandbanks Railless Electric Car Co., Ltd., is promoting a Bill for powers to work a system of railless traction from Branksome Park to Park Gates East. The T.C. has instructed the town clerk to oppose the Bill.

Sheffield.—The B. of T. has sanctioned the City Council's proposal to alter all speed limits of six miles per hour on its tramways to eight miles, and all limits of 10 miles to 12 miles per hour. The net balance on the working of the tramways during the present financial year is estimated at £28,500, and the traffic revenue is estimated at £386,100, as against expenses of £127,694.

South Africa.—During the progress of a terrific thunderstorm in Johannesburg, a tramway motorman named J. F. Hendry received a severe shock. He was driving a car up Orange Grove Hill when a flash of lightning struck the overhead wires. This affected the mechanism of the car, and whilst attending to it Hendry collapsed in the roadway and had to be conveyed to the hospital, where he is now recovering from the shock.

Westhoughton.—Tramway Facilities.—The General Purposes Committee of the D.C. has instructed the clerk to ask the Bolton Corporation to receive a deputation, to ask that Westhoughton be placed within the area of the extension of its tramway district.

Wolverhampton.—The Corporation Tramways Committee proposes to establish a service between Victoria Square and Upper River, and also between Victoria Square and Compton. The Town Clerk has been instructed to apply to the Leisdon R.D.C. and the Tettenhall D.C. for their consent to the services within their respective areas. The Tramways Committee has been authorised to purchase, at the estimated cost of £2,744, four motor-omnibuses for this service.

TELEGRAPH and TELEPHONE NOTES.

Belgium.—The Belgian Minister of Posts and Telegraphs proposes to issue new regulations subjecting the establishment of private receiving and transmitting apparatus to the sanction of the authorities. It is estimated that the number of receiving installations secretly erected in Brussels alone is about one thousand.

Germany.—A company has been formed in Hanover under the title of "Erforschung des Erdinnen," for the exploration of the interior of the earth by means of wireless telegraphy, according to a process devised by Drs. Löwy and Leimbach. The electric waves will be used to locate reservoirs of water, beds of ore, oil and gas accumulations, &c., with a view to turning them to profitable account. Practical tests, it is said, have already demonstrated the utility of the process.

Experiments of this kind were made years ago in this country, with varying success, but eventually the idea was abandoned. We doubt very much whether it is of any value.

Hull.—At a meeting of the Hull Chamber of Commerce on Monday a resolution was passed supporting the proposal of the Corporation's Telephone Committee to take over from the Government the old National Telephone system in the Hull area at a cost of £192,000, subject to the condition that a clause be inserted in the terms of arrangement giving power to the Government to ensure that the system at Hull be efficiently maintained in keeping with the telephone system of the country.

Ireland.—The Post Office authorities last week commenced work in connection with an extensive scheme for developing the telephone service in the Midlands and West of Ireland. Hitherto, messages from Dublin to Athlone and other towns in the centre of Ireland have had to go through Maryborough, but new trunk connections are now about to be made between Dublin and the more important centres in the provinces, and direct services are promised in the near future.

New Cable.—The *Times* correspondent at Colombo states that the cableship *Colonia* arrived there on Thursday last week. She laid 700 miles of cable in the Red Sea, and left Aden on November 23rd. On her voyage to Colombo she let down cable at the record rate of 9½ miles per hour. She will proceed to Malabar, and will return in January.

Norway.—The wireless station at Flekkerö suffered considerably during the heavy storms of last week, which ravaged the whole coast of Norway. One of the masts was broken in two like a match, and by its fall the whole aerial network of wires was torn in pieces. The damage done was enough to put the station out of use for at least a week.

Postal Servants.—At the conference of Postal and Telegraph Clerks at Leicester on Saturday a motion to adopt a strike policy, and to endeavour to make a compact with the National Union of Railwaymen, the Miners' Federation, and the Transport Workers' Union, was defeated by two votes. The conference, however, agreed to stand by any decision of the general body of postal workers on the strike question. The conference rejected the Holt report, and supported by a large majority the application for a 15 per cent. increase for all grades.

On Wednesday the National Joint Committee met and considered the situation in private, and communicated with the P.M.G., who consented to receive the whole of the Committee at the General Post Office on Thursday.

The Telephone Service.—In the course of a speech on Wednesday, Mr. Herbert Samuel said that during the past year the telephone service had been improved in many ways, but was still very undeveloped. The question was largely one of plant, and millions of pounds were being spent on exchanges, subscribers' equipment, trunk lines, &c. The quality of the service was below the standard his department was determined to attain.

U.S.A. Wireless Patents.—In 1910 the National Electric Signaling Co. began suit against the Telefunken Wireless Telegraph Co. of America, for infringement of two patents issued in 1909 to Prof. R. A. Fessenden, and owned by the National Co. On October 20th, 1913, the United States Circuit Court of Appeals handed down an opinion in which the Fessenden patents were sustained and the Telefunken Co. was declared an infringer.

Having these two patents adjudicated, the National Electric Signaling Co. at once began an action for injunction against the Marconi Wireless Telegraph Co. of America, which is alleged to be one of the largest infringers of the patents. A hearing in this case was held at Trenton, N.J., on November 17th, at which time Judge Rellstab issued a preliminary injunction restraining the Marconi Co. from further infringement except as to its pending contracts with the United States Navy. From the representations of the Navy Department it appeared to the Court that a severe inconvenience might result if the Marconi Co. were not allowed to deliver the instruments already contracted for, so this was permitted by the Court under the provision that there be given a bond of $25,000 for the protection of the owners of the Fessenden patents.

Following the order of Court described above, there was filed a motion to suspend the injunction, with affidavits from the Marconi Co.'s engineers stating that the apparatus complained of as infringing was installed at over 500 stations, and that to remove it would require some two months' time. In the argument before Judge Rellstab, on November 21st, at Trenton, the Marconi Co. stated that removing the apparatus immediately, as originally ordered, would so cripple the wireless service that if an accident at sea should occur, great loss of life might result. With this in view, Judge Rellstab suspended the injunction temporarily as to existing ship stations and those on shore intended for ship communication, but still restrained the Marconi Co. from installing the infringing apparatus at any new plants pending final settlement of the case. He further required a bond of $100,000 to guarantee payment to the National Co. of any damages which may be proved to arise from the partial suspension of the injunction.

The invention concerned is a method of sending and receiving wireless telegrams by the use of high-pitched sparks. These rapid musical sparks produce a distinct tone at the receiving station and so permit the operator to distinguish them from other and lower-pitched sounds merely by concentrating his attention on the desired signals.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" December 5th.

January 14th.—N.S.W. Government Railways and Tramways. Two electrically-driven turbine pumps, 50 gallons per minute, to specification No. 432, price 2s. 6d., obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney.

Melbourne.—March 18th, 1914. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

December 22nd. Melbourne Suburban Railways. Copper track bonds and accessories. See "Official Notices" November 28th.

January 27th.—Deputy-P.M.G. 17 switchboards and accessories. B. of T. Com. Intelligence Department in London.

Brisbane.—January 7th, 1914. Switchboards, parts and accessories. Schedule No. 274. Telephone instruments, &c. Stores Schedule No. 275. Measuring instruments, &c. Stores Schedule No. 277. Telegraph instruments, &c. Stores Schedule No. 276. Protectors, parts, &c. Stores Schedule No. 278. See "Official Notices" December 5th.

Perth.—January 21st. Deputy-P.M.G. Telegraph instruments and parts. B. of T. Com. Intelligence Department in London.

Belgium.—December 20th. The Belgian Post and Telegraph authorities (Salle de la Madeleine) are inviting tenders for the supply and erection in the basement of the General Post Office in Brussels of three air compressors and three vacuum pumps, all to be electrically operated.

Bootle.—December 17th. 400 tons of steam coal and 3,000 tons of slack for the E.L. station. Borough Electrical Engineer, Pine Grove.

Bradford.—December 19th. Corporation. One turbo-generator, about 5,000 KW.; storage batteries, boosters and switch and regulating gear; two 1,500-KW. rotary converters, transformers and switchgear. See "Official Notices" November 28th.

January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" to-day.

Canada.—BOWNESS, ALTA.—December 31st. For the Bowness Improvement Co., 200-KW. traction motor, one four-panel switchboard, one 250-K.V.A. generator, and a gas engine. Mr. T. L. Turabull, 220, 8th Avenue West, Calgary, is the engineer-in-charge.

MEDICINE HAT, ALTA.—The City Council has decided to call for alternative tenders for a 1,500-KW. and a 2,000-KW. electric generating unit, though it is probable the contract will not be awarded for some time.—*Canadian Electrical News.*

Cardiff.—December 16th. Steel grooved girder tram-rails, British standard section, Nos. 4 and 4 C (500 tons) and steel fishplates (23 tons) for the T.C. Mr. W. Harpur, City Engineer.

Carlisle.—December 31st. Corporation. Two 1,250-KW. high-pressure turbo-alternators; two sets of surface-condensing plant; two 600-KW. rotary converters; and high-tension switchgear. See "Official Notices" to-day.

Crete.—March 13th. Tenders to the "Bureau de la Mairie," Canea, for (1) a 50 years' concession to construct and work an overhead system of electric tramways in Canea and the neighbourhood; and (2) a 50 years' concession for the installation and maintenance of the water supply of Canea and suburbs. Tenders for these concessions were previously invited in June, 1912, and the conditions for the present call are the same as for the previous one.

Copies of the conditions, &c., may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Exeter.—December 15th. Steam coal (washed, bean or pea) for the Corporation Electricity Works (about 2,200 tons per six months). Mr. H. Lloyd Parry, Town Clerk.

France.—January 12th. The French State Railway authorities (Bureaux du Service Electrique), 43, Rue de Rome, Paris, are inviting tenders for the supply of 12 electrically-operated cranes at the railway engineering shops at Batignolles.

PARIS.—December 23rd. Supply of telephone commutator tables. Ministère des Postes et Télégraphes, 103, Rue de Grenelle, Paris.

Holland.—The Naamlose Vennotschap Electriciteits-fabriek (Yssel Centrale) of Zwolle, is at present inviting tenders for the establishment of a central electric lighting station in the town.

Jerusalem.—TURKEY.—December 31st. The Commission d'Adjudication du Government Ottoman. Construction of an electric tramway and the installation of an electric lighting service. Particulars at the Conak du Government Ottoman at Jerusalem.

Leigh (Lancs.).—December 19th. Corporation. Water-tube boiler, with mechanical stoker, forced draught plant, air heater, &c. See "Official Notices" December 5th.

Liverpool.—The Tramways Committee proposes to invite tenders for the supply of six motor-omnibuses.

London.—L.C.C.—December 23rd. Steam, exhaust, condenser, feed, &c., piping, water tanks, &c., for Greenwich generating station. See "Official Notices" December 5th.

The Highways Committee recommends that tenders be invited from selected firms for additional control gear and recording apparatus for use in connection with the dynamometric testing of car motors at the central car repair depôt; and for the supply of feeder pillar panels, switches, &c., for the Council's tramways.

ROYAL MINT.—December 15th. 100 tons of copper in ingots. See "Official Notices" December 5th.

SHOREDITCH.—December 16th. Corporation. Sub-station plant (transforming and converting plant, starting and controlling apparatus). See "Official Notices" November 21st.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

HACKNEY.—Tenders for the erection of electricity sub-stations. Time extended to December 22nd.

Manchester.—December 19th. Corporation. Motor-converters or rotary converters and static transformers as follows:—Four 1,000/1,250-KW. sets; one 1,000-KW. set; and two 650/800-KW. sets. See "Official Notices" December 5th.

December 16th.—The Corporation Tramways. Material for route number boxes: (*a*) metal fittings; (*b*) aluminium number plates; (*c*) metallic filament lamps. Particulars and forms from the Tramways Manager.

New Zealand.—February 19th. The Christchurch City Council invites tenders for (1) underground and aerial cables; (2) testing instruments; (3) underground troughing and covering; (4) transformers; (5) meters and demand indicators; (6) marline, tape and rubber mats; (7) enamelled iron tablets; (8) insulators; (9) service fuse boxes. Specifications 10s. each, or £3 for complete set of nine. Apply High Commissioner for New Zealand in London.—*New Zealand Shipping and Commerce.*

Roumania.—December 20th. The municipal authorities of Targu-Ocna are inviting tenders for the establishment of a central generating station, and for the electric lighting of the public streets, the latter having a length of about 12 miles.

South Africa.—Heidelberg (Transvaal) municipality is about to invite tenders for the proposed electric lighting scheme, and has been advertising for the names of local firms wishing to participate.—*African World.*

JOHANNESBURG.—January 10th. Six alternating-current to direct-current converters for the Municipality. Specifications from the General Manager, Gas, Electric Supply and Tramways Department, President Street, Johannesburg.

DURBAN.—January 7th. Gas-electric plant for the Municipality. Town Clerk, Municipal Buildings, Durban. Copies of specifications at the office of the Borough Engineer, Municipal Buildings, Durban, £1 1s.—*British and S.A. Export Gazette.*

South Shields.—December 13th. Corporation. Two water-tube boilers, with mountings and fittings, &c.; one economiser. See "Official Notices" November 28th.

Spain.—December 18th. Tenders are being invited until the 18th inst. by the municipal authorities of Agudo (Province of Ciudad Real) for the concession for the electric lighting of the town during a period of years.

The municipal authorities of Borja (Province of Zaragoza) have lately invited tenders for the concession for the electric lighting of the town during a period of six years.

Wigan.—December 22nd. Corporation. Six double-deck tramcar bodies with top covers, six trucks, six complete electrical equipments. See "Official Notices" to-day.

Wolverhampton.—December 16th. Supply and laying of cables, re-wiring lamp standards, &c., Heath Town Workhouse, for the B. of G. Mr. F. Harrison, Clerk.

Worksop.—December 15th. Electric light installation (123 lamps) for the B. of G. Mr. J. S. Whall, Clerk, 66, Bridge Street.

York.—December 22nd. Corporation. Stores for electricity and tramways department. See "Official Notices" December 5th.

CLOSED.

Argentina.—The Santa Fe Municipality has contracted with Messrs. Barnes & Gross, of Rosario, for the supply of 500 arc lamps for the public lighting service. The contract price is about $50,000.—*Review of the Rirer Plate.*

Australia.—The following tenders have been accepted:—

N.S.W.—Postmaster-General's Department.

9,200 rectangular dry cells, 2s. 1d. each—W. G. Watson & Co., Ltd.
54,000 ft. glazed earthenware conduit.—Hoffman Brick and Potteries, Ltd.
Two sections of switchboard, common battery, multiple, for the Sydney Telephone Exchange, £2,824.—British General Electric Co., Ltd.

VICTORIA.—Postmaster-General's Department.

Telephone material.—Western Electric Co. (Aus.), Ltd.

TASMANIA.—Postmaster-General's Department.

Telephone material.—Western Electric Co. (Aus.), Ltd.
500 electrical registers, 7s. 9d. each.—G. Bartram & Son, Pty., Ltd.

MELBOURNE.—

Telephone material.—J. Bartram & Son., Ltd.
2,000 jacks, five-part, £67; 500 combined listening and ringing keys, £76; 15 miles paper-insulated, lead-covered cable, 416 pairs, 12½-lb. conductors, not served, £16,500; 15 miles ditto, 26 pairs, 12½-lb. conductors, served, £2,490.—B.I. and Helsby Cables, Ltd.—*Australasian Record.*

Prahran and Malvern Tramways Trust.

Tramway points and crossing, £917.—The Steel Co. of Australia.—*Tenders.*

GOULBURN (N.S.W.).—A contract has been secured by the I.R., G.P. and Telegraph Works Co., Ltd., Sydney, for the whole of the plant, consisting of 128-B H.P. Hornsby suction gas plant, two 75-KW. 480-500 Silvertown generators, belt-driven, and equipped with static balancers, and a motor-driven three-wire booster.—*Commonwealth Engineer.*

Bacup.—The Corporation has decided to order 12 three-ampere meters from the B.I. and Helsby Cables, Ltd.

Batley.—The Electricity Committee has accepted the tender of the Leeds Meter Co. for pipe scraper apparatus (£120).

Bradford.—The Corporation Sewage Committee has accepted the tender of Messrs. Whitehead & Poole, Ltd., of Manchester, for an electrically-driven revolving sewage screen, with reducing gear and motor complete, for £288, for the Esholt Sewage Works.

The Visiting Committee of the Board of Guardians has accepted the tender of Mr. Charles Bell, of Bradford, for the alteration of the electric lighting installation at the Guardians' laundry.

The City Council has accepted the tender of Messrs. G. A. Steinthal & Boydell, Ltd., for installing electric light at the Technical College, at £539.

Caledonian Railway.—The Edison & Swan United Electric Light Co., Ltd., have secured the contract for the supply of electric lamps to the Caledonian Railway Co.

Canada.—The Canadian British Insulated Co., Ltd., has received an order from the Hydro-Electric Power Commission of Ontario for 24,000 ft. of 300,000 cm. three-core paper-insulated lead-covered cable, for 13 000-volt service.

The City of Winnipeg has awarded contracts as follows :—Three 600-KW. transformers and electrolytic lightning arresters, the Canadian General Electric Co.: switches to Ferranti, Ltd.—*Canadian Electrical News.*

Colne.—Tenders received for the installation of a water softening and grease eliminator plant at the electricity works have been referred to a Sub-Committee with power to act.

Darlington.—The T.C. has accepted the tender of Messrs. Dove & Co., of Darlington, for the wiring of outside lamps.

East Ham.—The tender of Babcock & Wilcox, Ltd., has been accepted by the T.C., at £534, for two automatic stokers for the generating station.

France.—The results of the adjudication on the tenders called for on November 11th by the French Ministry of Public Works, Posts and Telegraphs for rubber and cotton-covered copper wire, with two conductors, are the acceptance of the following offers :—

Société Industrielle des Téléphones.—First and second lots, 109 90.
Geoffroy et Delore.—Third lot, 96 65; fourth lot, 96.55; and fifth lot, 96.35.

Ilkley.—The Town Hall Committee, after considering schemes for lighting the Winter Gardens by electricity, has resolved to obtain the necessary fittings from Mr. Charles Bell, of Bradford.

Keighley.—The Corporation Tramways Committee recommends the Council to accept the tender of the Cedes Electric Traction, Ltd., for the supply and erection of overhead equipment on the Oakworth and Eastburn trolley vehicle routes at an inclusive price of £923 per mile, and for the supply of four trolley vehicles at £720 each. The approximate length of the route is six miles, seven furlongs.

The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd, for a spare motor, at £500.

Llandaff and Dinas Powis.—The U.D.C., on December 3rd, accepted the tender of the B.I. and Helsby Cables, Ltd., for cables and laying, at £3,161.

London.—WESTMINSTER.—The City Council has accepted the tender of Speedy, Eynon & Co., at £20, for rewiring and rearranging the electric lights at the Buckingham Palace Road Library.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N E, have obtained the contract for tantalum and Wotan drawn-wire lamps for the Metropolitan Railway for the ensuing 12 months.

L.C.C.—The Highways Committee has placed a contract with Messrs. Cammell, Laird & Co., Ltd., for 100 axle forgings, 5¼ in. diameter, at £2 1s. 9d. each.

L.C.C.—The Stores and Contract Committee recommends the acceptance of the following tenders :—For electric carbons (Schedule No. 13) for 12 months, Crompton & Co., Ltd., items 2, 3 and 4; and the Sloan Electrical Co., items 1 and 5.

HACKNEY.—The Electricity Committee has accepted the tender of Rice & Son, Stockwell Road, S.W., of £11,569, for the completion of the electricity works extensions.

STEPNEY.—The Electricity Committee. For the supply of switchgear, the following firms tendered :—

Reyrolle & Co., Ltd.	(recommended)	£6,275
Johnson & Phillips, Ltd.		6,656
Switchgear & Cowans, Ltd.		6,732
British Westinghouse Electric & Manufacturing Co., Ltd. ..		7,012
British Thomson-Houston Co., Ltd.		7,200

The Highways Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for 16 armatures (class 220), and 80 field coils at £38 18s. an armature and £6 a coil; 20 coupler heads have been obtained from the A.B. Coupler, Ltd., at a cost of £60 for fitting to standard cars for use with trailers, also six buffer heads for tractors, and bufferhead couplers for trailers as spares, at £27.

BATTERSEA.—The B.C. is purchasing from the British Vulcan Soot Cleaning Co., for £83, an apparatus which is designed to facilitate the cleaning of the No. 10 boiler at the central generating station.

Manchester.—The Electricity Committee of the Corporation has accepted the following tenders :—

1,800/2,200-KW. converter for Dickinson Street sub-station.—Bruce Peebles and Co., Ltd.
Supply of 12 months' requirements of static transformers.—Ferranti, Ltd.
Supplies of cable.—W. T. Glover & Co., Ltd.; Liverpool Electric Cable Co., Ltd.; Charles Macintosh & Co., Ltd.; and Johnson & Phillips, Ltd.

Rotherham.—The T.C. has accepted the tender of the Rees Roturbo Engineering Co., at £488, for motor-driven pumps at the sewage outfall works.

Sheffield.—The City Council has accepted the tender of the Brightside Foundry and Engineering Co., Ltd., at £73, for installing hot-water supply apparatus at the Holme Lane car depôt.

St. Helens.—The Electricity Committee has accepted the tender of Callender's Cable and Construction Co., Ltd., for cable required in connection with the new 600-KW. rotary converter.

Tunbridge Wells.—The T.C. has accepted the tender of Mr. H. A. Stonham for installing the electric light at the sanatorium, at £105.

Wakefield.—The Electricity Committee has accepted the tender of the Victoria Coal and Coke Co. for coal.

Walsall.—The following tenders have been accepted by the T.C. :—

General Electric Co., Ltd.—Sub-station gear, £41 10s.
G. Robson & Co.—Combined electric track grinder and drilling machine.

Watford.—The tender of the Electrical Construction Co. has been accepted by the U.D.C., at £52 10s., for a new feeder panel.

Wolverhampton.—The Corporation Electricity Committee has accepted the following tenders :—

Willans & Robinson, Ltd., £13,159, for a 4,000-KW. turbo-alternator with condenser, and steam and water pipes, &c.; and
A. Reyrolle & Co., Ltd., £650, switchgear for the extension plant.

Worthing.—The T.C. has accepted the tender of Messrs. Bodle & Addison, of Eastbourne, for extensions to electricity works, at £1,787.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

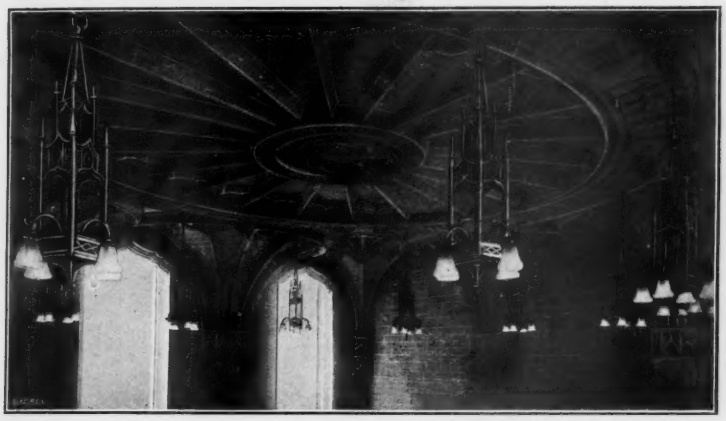
Monday, December 15th.—"A" Company. Technical instruction 7 p.m. to 10 p.m.
Tuesday, December 16th.—"B" Company. Ditto.
Wednesday, December 17th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.
Thursday, December 18th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.
Friday, December 19th.—"D" Company. Special class on Crossley engine, 7 p.m. Technical instruction, 7.30 to 9.30 p.m.
Saturday, December 20th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

Strike at Schenectady.—Labour troubles at the Schenectady Works of the General Electric Co. have resulted in partial cessation of work there. On the morning of November 25th, after negotiations between the company and representatives of the men, from one-third to one-half of the employés struck. During the day many of those who had remained at their posts in the morning left their work. A number of the men have since returned to work, and at the time the *Electrical World* of November 29th went to press, about 13,000 were out. Two workers who were laid off are the ostensible cause of the trouble. These employés were said to have been active in Union matters, and for that reason the action taken by the company in regard to them was made the basis of a strike. Another definite cause which had a potent influence in the matter was the existence of Unions among the employés between which there has always been strong feeling. Mr. G. E. Emmons, manager of the Schenectady Works, made a statement to the effect that, owing to a falling-off in business, it had become necessary for the General Electric Co. to reduce force in all of its apparatus factories, the Schenectady Works being the last to be affected. Instructions were accordingly issued to the superintendents of the various divisions directing that such reductions in force as were necessary to meet business conditions should be made. Without any intent to discriminate against any individuals or class of employés, it happened, on the merits of the case, that a certain man and woman who had been prominent in labour matters were laid off, among others in the department where they were employed.

ELECTRICITY AT THE MIDDLESEX GUILDHALL.

An installation of more than ordinary interest has recently been carried out at the new Guildhall of the County Council of Middlesex, in Westminster, by Messrs. A. V. Gifkins and Co., to the specification of Mr. R. A. Smith, M.I.E.E. The building is a very fine example of high-class architecture, in a style resembling that of the Tudor period, which harmonises admirably with the environment—the site being close to Westminster Abbey and other historic buildings; the architects were Messrs. J. S. Gibson, Skipwith and Gordon, in collaboration with Mr. H. T. Wakelam, M.Inst.C.E., the County Surveyor, and the general contractor for the building was Mr. J. Carmichael.



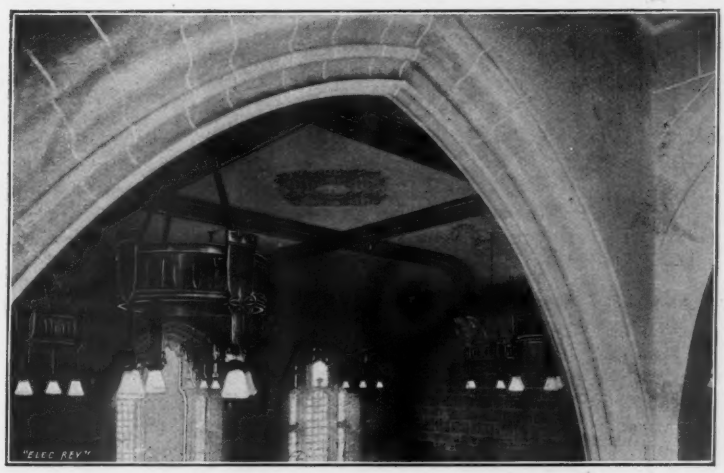
Middlesex Guildhall: Court No. 1.

The equipment comprises, in addition to the electrical installation, a steam heating system and domestic hot water supply, and the arrangements for heating and ventilation have been carried out with exceptional completeness and foresight.

The wiring is enclosed throughout in screwed solid-drawn steel barrel, the whole of which was laid before a single wire was run. The ends of the pipes are fitted with smooth brass bushes wherever they enter boxes. The latter are of cast-iron, and are provided, where necessary, with bridge-pieces for adjusting the switch-plates to suit any possible variation in the final level of the plaster; the switches are all of the flush type, with plates finished to match the corresponding fittings.

The cables were supplied by Messrs. W. T. Glover and Co., Ltd., of the C.M.A. 2,500 and 600-megohm class; the largest are 37/16, supplying the main switchboard, which is fixed in the basement. Connections are made to both sides of the Westminster Electric Supply Corporation's three-wire system, to balance the load as closely as possible. An entirely separate connection, however, is taken from the mains to the electric kitchen, which is in a room on the third floor; the main cable in this case is paper-insulated, lead-covered and armoured, size 37/14.

The main switchboard consists of three marble panels, carrying D.P. switches and fuses; the centre panel provides for the three larger motors at 400 volts across the outers, and each of the other panels, at 200 volts, carries 11 ways for lighting, and two ways for power, besides two main switches for these sections. The power installation comprises a passenger lift, three service lifts, sump and sewage pumps, and four ventilating fans. Two fans in the basement are blowers, driven by 2½-H.P. 200-volt Holmes variable-speed motors; two in the tower are exhaust fans, similarly driven, and all are controlled by two starter and regulator panels, made by Messrs. A. V. Gifkins & Co., and fixed in the basement. To prevent accident to workmen, a three-pole switch in a lock-up case is provided in the tower fan room, by means of which the mains and the shunt connection to the fan-motors can be completely cut off from the supply.



Court No. 2.

About 30,000 ft. of conduit and 20 miles of wire (including that used for bells and telephones) were required to carry out the work.

The whole of the ornamental fittings used in the Guildhall were made by Messrs. H. H. Martin & Co., under the direction of Mr. O. R. Albrow, and were specially designed to suit the surroundings in which they would be used. They differ,

Council Chamber.

accordingly, in the various halls, and as the beauty of a fitting cannot be justly apprehended unless it is seen in the appropriate setting, we have photographed the upper parts of the principal rooms with the fittings in place.

In the Council Chamber there are six electroliers, each carrying eight 32-watt tungsten lamps, in two sets, fed from different circuits. Each fitting is of hand-hammered metal with a plume bronze finish, and weighs over $1\frac{1}{2}$ cwt.

Court No. 1 is provided with 12 fittings in bronze, each of which carries four 32-watt lamps; and Court No. 2 has eight corona fittings, six of which carry four lamps and two five lamps each.

The main corridors are provided with two-light fittings, shown in one of our views, and the staircase will be lighted by a very handsome electrolier.

The kitchen contains an unexpectedly large array of electric cooking apparatus, the whole of which is of the "Tricity" make, and was supplied and fitted by Messrs. A. V. Gifkins & Co. The 800-watt standard heating unit,

Electric Cooking Apparatus: Grill, Ovens, &c.

with double control, is used throughout the installation, in connection with the special plug-boards, with signal lamp, &c., supplied by the British Electric Transformer Co. for the purpose. Thirty of these units are provided, making a total maximum demand with other apparatus of 29·5 kw.

There are two double ovens, each fitted with four units, and built in two compartments; over these are hoods. A large double grill of the standard hotel type is provided, with four heating units—two above and two below; under the grill is a large hot cupboard, capable of warming 150 plates, and provided with portable racks holding 30 plates each.

In the middle of the room is a carving table fitted with four units; on the top are two hot carving dishes, and below there is a hot cupboard.

The remaining apparatus includes three steamers, each large enough for three 12-pint saucepans, and fitted with two heating units; two 2-gallon copper urns; one fish-kettle; one ham-boiler; one milk-saucepan; two bains-marie, with copper pots; and one large fish frier, heated by two units.

The tables are covered with polished pewter, the walls are lined with white tiles, and the whole kitchen presents apicture of neatness and cleanliness unapproachable with any but the electric system of cooking.

The bell and telephone installations are of the same high quality as the rest of the equipment. All the wiring—which is insulated with "Pernax"—is enclosed in solid-drawn screwed barrel; the bell-pushes are of Messrs.

Fittings in Corridor.

Lundberg's "Pixie" type. The bell system is exceptionally complete, single bell circuits from room to room being used in many cases in addition to indicator systems. A 30-line private telephone exchange is installed.

The heating apparatus for the Courts and the Council Chamber, installed by Messrs. Rosser & Russell, Ltd., is controlled by an automatic electrical regulator.

The whole undertaking reflects credit alike on the engineers and contractors, and is worthy of the fine building which it is to serve. We are much indebted to Mr. R. W. Willis, A.M.I.E.E., who has supervised the work on

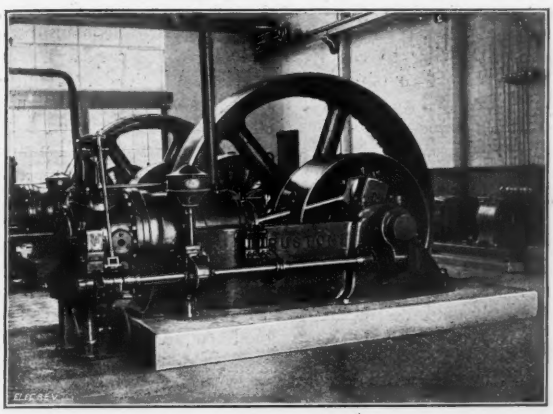
Carving Table and Various Utensils.

behalf of Mr. R. A. Smith, and to Mr. G. H. Kilsby, of Messrs. A. V. Gifkins & Co., for their kind assistance in compiling these notes.

SMALL ELECTRIC LIGHT AND POWER UNDERTAKINGS.

By H. P. GIRLING, M.I.E.E.

There has been much discussion recently in these columns concerning the possibilities of the development of electric lighting in villages, and I firmly believe that there is considerable scope in this direction provided the problem is



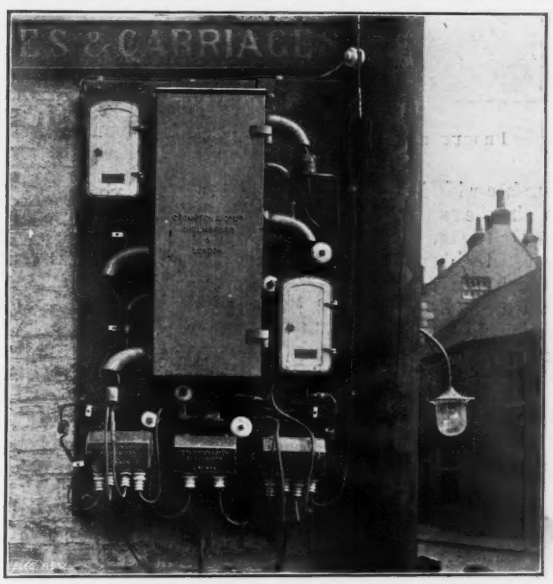
Gas Engine Plant, Barton-on-Humber E.L. Station.

tackled in a common-sense, businesslike way. Villages must inevitably be treated upon different lines to small towns; in fact, there is just as much difference between the two propositions as there is between the provision of electric supply for a small town and for a large city.

A very good object-lesson is found in methods of supplying ordinary everyday necessities. For example, the grocer in the village is more often than not also the linen draper, and may also supply newspapers, tobacco and boots, and sometimes he is a universal provider in a humble way. Then, again, he does not wait for customers to come in from the outlying farms, and other scattered houses, but two or three times a week sends out a miniature shop on wheels, to catch those who might otherwise leave their shopping to a weekly visit to the nearest market town, and generally to encourage trade.

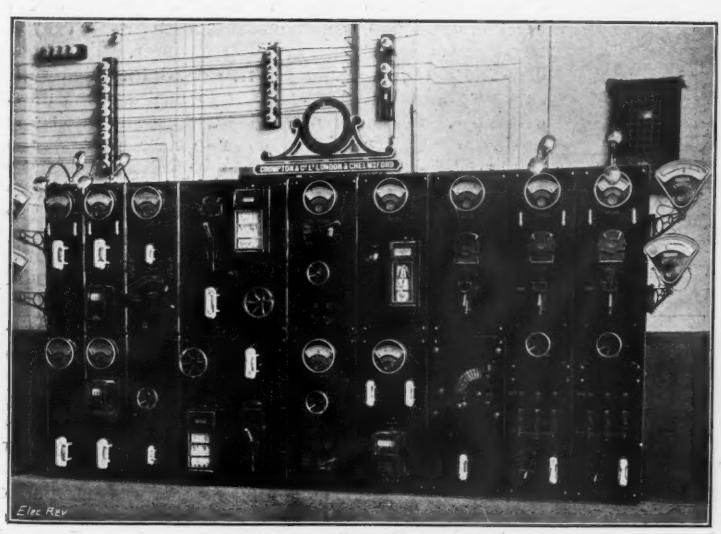
Electricity, to be a success in a village, must be supplied on the same lines; it must be an additional commodity offered by the local cycle engineer, plumber, repairer of property, builder, or even the blacksmith, any of whom, if personally intelligent, can be trained to run the "central station" as a well-paying hobby, the wiring being done by an electrical man from the nearest town if the promoter is not prepared to undertake it himself. If no suitable tradesman can be found, it often happens that there is a well-to-do resident in or near the village who desires the convenience of water and light in his own house on modern lines, and has the interest of the village sufficiently at heart to entertain a scheme for public lighting, especially if he can be satisfied that it will be self-supporting, and if he has a chauffeur who can, by attending to it, earn part of his wages.

To come to the point with which this article is more directly concerned, viz., the supply of electric light and power to small towns; there is, of course, a much better chance of securing the necessary consumers and financial support in this case. Though not absolutely essential, two very important factors in the successful operation are street lighting and a power load, since while private house lighting



Terminals for Overhead Lines.

may be the most remunerative per unit supplied, it is generally insufficient to maintain an efficient special staff except, perhaps, at seaside towns and other holiday resorts where an exceptional demand for plenty of good light is experienced. When neither of these two outlets is obtainable, the problem has to be dealt with on similar lines to village lighting as above described, if it is to pay its way.



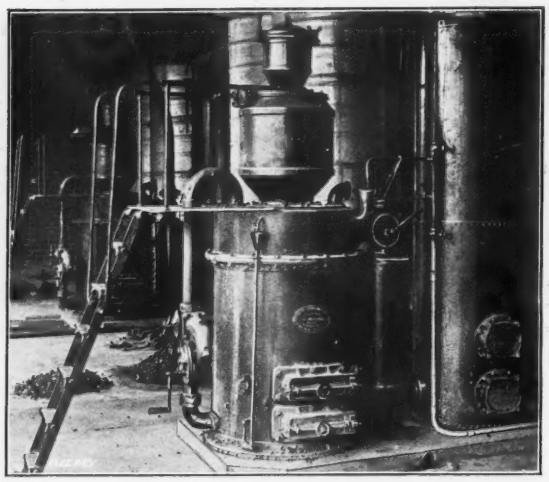
View of Main Switchboard.

A third, and still more important, factor in small town lighting on a successful basis is found in overhead wiring. There are very few unpretentious towns that can afford the doubtful luxury of underground wiring. It costs five or six times as much, and is a continual source of annoyance both to the engineer in charge and the "man in the street."

The necessary additional capital outlay involved by underground wiring usually cripples the small concern hopelessly, which struggles to rectify matters by a higher price per unit, thus choking off prospective consumers, and sounding its own death knell.

Then, again, even if it is a fairly wealthy neighbourhood, and the money is

forthcoming, the new company, though successfully floated, gets itself into bad odour from the start by disturbing all the roads, and continues to be a nuisance so long as new consumers are being connected; and after this has died down to unimportance by its infrequent occurrence, it is more than probable that faults may begin to develop, again necessitating the disturbance of the road



Producer Plant, Barton-on-Humber E.L. Station.

surface with its accompanying adverse comments tending to make the supply unpopular.

On the other hand, overhead wiring and services can be erected without incommoding the public at all, and faults, which are much less likely to occur, can generally be detected very readily and rectified without their occurrence being known. The objection of appearance is often raised, but can be overcome by well-designed steel poles in the more important thoroughfares, and neat wooden ones in the outlying districts, especially if people are well informed that current will be available at a lower rate as a result of overhead wiring, and much annoyance to them will be avoided.

A brief description of the plant and general conditions

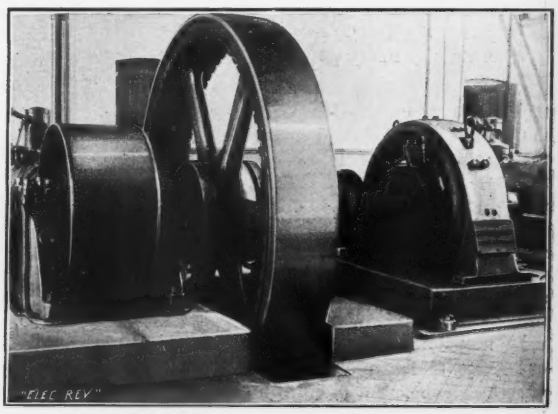
Overhead Transmission and Street Lighting.

at Barton-on-Humber will serve to illustrate the usual difficulties met with, and points of interest which arise in connection with small town supply.

By way of introduction, it may be stated that the conception and inauguration of this scheme were almost entirely due to the enterprise of Mr. F. Hopper, the founder of the large cycle factory in Barton-on-Humber, known as the Elswick-Hopper Cycle and Motor Co., Ltd., which now employs some 800 persons, and sends out, amongst other things, about 1,000 cycles per week to all parts of the world.

The electric lighting and power scheme originated from the uncompromising attitude of the local gas company, and the consequent demand for some other and better form of light to compete with gas. Street lighting was one of the chief troubles, and this was met by an offer from Mr. Hopper to undertake a 12 years' street lighting contract for 150 electric lamps of 100 c.p. each at £2 2s. per lamp per annum, from lighting-up time until 12 o'clock midnight during the lighting season. This offer was accepted, and the present company, with a nominal capital of £20,000, was the result. The company has a very excellent prospect before it, owing to the local industry consisting largely of the manufacture of bricks and tiles, which only require power in the daytime of the summer months. This should prove an immense help to the establishment of a good load factor. In addition to this, there are numerous small power consumers, as well as one or two using several hundred horse-power each, in the district.

It is not proposed to issue the whole of the shares at present, as a good margin has been allowed for future extensions. It is interesting to note, however, that nearly half the total amount has already been subscribed locally, and fully paid up in £1 shares issued at par, thus establishing the company on a good sound financial basis,



Crompton Generator, coupled to Gas Engine.

especially as the directors include some of the most influential gentlemen of the district.

As regards plant which has actually been laid down, the buildings, which are often dealt with on the "anything will do" principle, have in this instance been very carefully thought out, and specially erected to the designs of a local architect, Mr. W. Stamp, who has not neglected to make them of good appearance, and has been assisted by the writer in his capacity of consulting engineer. They consist of a lofty engine room, 65 ft. × 28 ft., fitted with a suitable overhead travelling crane to facilitate repairs and extensions, a lean-to on one side accommodating gas producers with a reinforced concrete floor above for the storage of fuel, which can thereby be fed straight through hoppers by gravity to the producers. The side of this lean-to, which is partly open at the top, has the ground floor entirely closed in by sliding doors to admit of unlimited ventilation.

On the other side of the engine room is a second lean-to forming the battery room, stores and offices.

In addition to this, a very nice engineer's house has been erected on an adjoining site with a showroom in the front, which has the obvious advantage of making it easy to keep goods on show all day and throughout the evenings with very little expense or trouble, and, incidentally, there is a much greater likelihood of the chief being in the power house quickly should any emergency arise which may enable him to avert serious trouble. It also gives him numerous opportunities of tackling prospective consumers while they are in the mood to listen to his propositions. It may be suggested that the engineer does not always want to be too

handy to be bothered by just anybody and at all hours; but if he has the success of his undertaking at heart as he should have, this will not be the case in a small town, whatever it might be in a larger one.

The generating station at Barton has been designed for two 70-H.P. units as already installed, with room for one 140-H.P. set at one end of the building, and ample space to extend the building at the same end when necessary. In addition to this, an arrangement has been made whereby power shall be available in emergencies from the cycle factory of the Elswick-Hopper Cycle and Motor Co., Ltd., on the adjoining property, where some 400-H.P. of generating plant is in operation.

The plant installed by the Barton-on-Humber Electric Supply Co., Ltd., includes two 70-H.P. anthracite suction gas plants and engines by Messrs. Ruston Proctor & Co., Ltd., of Lincoln. The engines are fitted with their electric lighting type heavy fly-wheels and throttle governing, with the result that a very steady voltage is obtained.

Each of these engines is directly connected by means of a Zodel Voith flexible coupling to a 45-KW. 440-480-volt Crompton continuous-current interpole compound dynamo with a single-pole handgrip ironclad fuse attached to it to avoid the otherwise fatal consequences of a short in the mains between it and the switchboard.

The auxiliary plant includes a double hand reversible motor-driven booster, consisting of three machines coupled together on one bedplate, and a C.M.B. balancer capable of dealing with 40 amperes out of balance. Both of these are of Messrs. Crompton & Co.'s manufacture and are doing their work very satisfactorily.

The whole of the apparatus is controlled from a 19-panel switchboard which has been erected along the wall dividing the engine room from the battery room, and right up at the extension end of the building, so that there will be ample room for adding to it, and it may be somewhere near central when the station has assumed its probable final dimensions.

The switchboard was also supplied by Messrs. Crompton. The dynamo panels are fitted with the usual meters, shunt regulators, voltmeter plugs and pilot lamps. A S.P. overload and reverse loose-handle type circuit-breaker is fitted in one pole, and a porcelain handgrip damped fuse in the other pole. The dynamos are also arranged with the aid of a D.P. field-breaking switch and three-pole change-over main switch (positive, negative and equalising) to start the gas engines electrically by means of one of the boosters. One position of this main switch is arranged to join the booster armature terminals direct across the terminals of the generator with the compound winding cut out. When ready to start the engines, the gas is turned on full and the engine put on half compression. The booster is then started up and adjusted to give two or three volts in such a direction that the positive of the booster armature shall be connected to the positive of the generator armature when the main three-pole switch is closed in the starting position. This operation is then performed and the pressure on the booster increased gradually by means of its shunt regulator so as to maintain the current through the dynamo armature at about its normal full-load rating. This current is allowed to pass until the engine fires sufficiently to bring the current down to nearly zero, when the circuit is immediately broken and the voltage of the generator adjusted in the usual way as soon as full speed is obtained, when it can be paralleled by dropping the main switch into the running position.

This method is found to be very satisfactory, and is a great improvement upon compressed air or other means of starting owing to its almost unlimited capacity since the booster motor takes a trivial amount of current to supply the heavy low-voltage current required, *i.e.*, only about 10 or 15 amperes are taken from the battery during the process.

The booster panels are fitted with an auxiliary circuit arranged to avoid the possibility of an accident due to the booster being switched into circuit with the battery, before the motor is started, or the motor being shut down before the booster is taken out of the battery circuit, either of which operations would be very liable to cause the booster to race and burst by centrifugal force, a fact which central-station engineers know to their cost. To accomplish this an overload circuit-breaker is fitted in one pole of the motor circuit, which short-circuits the no-volt coil on the motor starter if, due to any cause, it should trip. This, of course, throws the motor starter into the "off" position, and thereby closes an auxiliary circuit by means of a small short-circuiting switch attached to the handle, provided the three-way booster switch is in the position to connect the booster in series with the battery, when it also closes the same auxiliary circuit at another point by means of a similar short-circuiting switch on its underside, and two small contacts. This auxiliary circuit includes a shunt-coil round the battery circuit-breaker powerful enough to trip it, thus preventing the battery from driving the booster, as would otherwise be the case.

This would, of course, mean a momentary discontinuity in the supply if there happened to be no engine sets connected on to the bars at the same time, but it only requires a moment to get the booster three-way switch on to the battery terminal, and to close the battery breaker, or, alternatively, to get the booster motor running again, and it is certainly better to risk this than the possible expense of rewinding a booster and repairing any consequential damage, which might be of a very serious nature.

The writer has had this arrangement fitted elsewhere, and in every case it has had occasion to fulfil its function sooner or later, especially when a new hand is on the switchboard. This more than warrants the slight extra expense involved.

Each of the battery panels has an overload loose handle circuit-breaker fitted with the above auxiliary coil, a porcelain handgrip fuse in the other pole, and a hand wheel connected by bevel gears to the single function battery regulating switches mounted on the wall behind the board, so that bare connections can be taken from the back of it direct to the regulating cells in the accumulator room behind. The position of the switch on the contacts is made clear by means of a mirror suspended above the board.

An integrating recording wattmeter is provided to indicate the total number of units generated, and in addition there are a pair of ampere-hour meters arranged to integrate the total watts delivered at the declared voltage, for checking the house-service meters.

The battery supplied by the Tudor Accumulator Co. consists of 260 cells capable of a discharge rate of 66 amperes for six hours down to 1·8 volts per cell; the plates are mounted in glass boxes of such size that additional plates can be added so that the battery can be brought up to a capacity of 100 amperes for six hours down to 1·8 volts per cell, if required later on.

The mains are of the overhead type, consisting of bare single-strand copper supported on creosoted wooden poles in the outlying district, which have been finished off by having painted battens banded on to them for about 4 ft. up. In the better streets, however, painted steel poles with dwarf bases have been used for the sake of appearance, and in the leading streets, which are very narrow, underground lead-covered cable has been drawn into earthenware pipes, these cables being of the four-core type, so far as the distributors are concerned, and two-core feeders. The branches are connected by married joints in hermetically sealed lead joint boxes filled up with compound.

Lightning arresters, and the necessary choke coils have, of course, been fitted wherever the overhead work joins the underground, and the neutral wire is well earthed at the ordinary Board of Trade station earthing panel.

The street lamps are controlled in groups by Venner time switches, which are designed to give morning lighting as well as evening lighting when required.

The mains and machinery have been very neatly installed by Messrs. Crompton & Co.'s contract department, and the whole of the work has been carried out to the writer's specification.

It is interesting to note that wiring for lighting purposes to the extent of considerably over the equivalent of 1,000 20-watt lamps was completed ready for use before the first engine was started up in July last, in addition to a good power and heating load, and that some considerable extensions to the mains have already been carried out, and others are under consideration.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, December 12th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, December 12th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Primary Batteries," by Mr. A. Bucklitsch; "Secondary Batteries," by Mr. H. J. Roberts.

Junior Institution of Engineers.—Friday, December 12th. At 8 p.m. At 39, Victoria Street, Paper on "Efficiency of Production," by Mr. H. N. Munro.

Saturday, December 13th. At 7 p.m. Reception, Dance and Whist Drive, at Caxton Hall, Westminster.

Manchester Association of Engineers.—Saturday, December 13th. At Grand Hotel, Aytoun Street. Paper on "Commercial Motor Road Traffic," by Col. R. E. Crompton.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 13th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

Monday, December 15th. At 8 p.m. At Chemical Theatre of Armstrong College, Newcastle. Fifth and last lecture on "Utilisation of Fuel," by Prof. J. W. Cobb.

Institute of Marine Engineers.—Monday, December 15th. At 8 p.m. Paper on "Electric Welding," by Mr. J. B. Hamilton.

Royal Society of Arts.—Monday, December 15th. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture (III) on "The Measurement of Stresses in Materials and Structures," by Prof. E. G. Coker.

Wednesday, December 17th. At 8 p.m. Paper on "The Channel Tunnel," by Mr. A. Fell.

Physical Society.—Tuesday, December 16th. At 3 to 6 p.m. and 7 to 10 p.m. At Imperial College of Science, South Kensington. Annual exhibition. At 4.30 p.m. Discourse on "Spiral Electric Discharges," by Prof. the Hon. R. J. Strutt.

Illuminating Engineering Society.—Tuesday, December 16th. At 8 p.m. At the Royal Society of Arts, 18, John Street, Adelphi. Paper on "Daylight Illumination, with special reference to School Planning," by Mr. P. J. Waldram.

Institution of Civil Engineers.—Tuesday, December 16th. At 8 p.m. At Great George Street, S.W. Ordinary meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, December 16th. At 7.30 p.m. At the University (Physical Laboratory). Paper on "Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, December 16th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Papers.

Institution of Electrical Engineers (Students' Section).—Wednesday, December 17th. At 7.45 p.m. At Victoria Embankment, W.C. Discussion on "Underground and Surface Transport of Passengers and Goods in London."

Institution of Electrical Engineers.—Thursday, December 18th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Chemical Society.—Thursday, December 18th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Institution of Electrical Engineers (Birmingham Local Section).—Friday, December 19th. At 7.30 p.m. At the Grand Hotel. Annual Dinner.

Institution of Mechanical Engineers.—Friday, December 19th. At 8 p.m. At Storey's Gate, S.W. General Meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 19th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Junior Institution of Engineers.—Friday, December 19th. At 8 p.m. At 39, Victoria Street. Paper on "Continuous Feeding Elevators," by Mr. T. C. Morewood.

Saturday, December 20th. At 2.30 p.m. Visit, Generating Station at Stratford.

Association of Mining Electrical Engineers.—Saturday, December 20th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Electric Winding," by Mr. J. Gillespie.

NOTES.

The Christmas Holidays.—We shall be glad if readers and advertisers will take special note of the following arrangements consequent upon the ELECTRICAL REVIEW for December 26th having to appear on the morning of Wednesday, December 24th.

It will be necessary for that issue to go to press much earlier than usual, and it is imperative that all communications for the editorial department, except the latest items of special news, should be sent in so that we receive them by Monday morning, December 22nd.

The advertisement department announces elsewhere in to-day's pages, that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than Friday morning, December 19th. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, 23rd inst.

Northampton Institute.—On Friday and Saturday last the staff, students and friends of the Northampton Polytechnic Institute, Clerkenwell, as usual at this time of the year, gave themselves over to the interesting proceedings connected with their annual prize distribution and conversazione. This time the prizes and certificates were handed to successful students by Mr. Cyril S. Cobb, chairman of the L.C.C. Dr. R. Mullineux Walmsley, the principal, made an interesting report on the work of the year, and after the distribution there were the usual demonstrations in the laboratories and workshops, an organ and choral concert in the Large Hall, and several lecturettes, including one by Mr. Samuel Field, head of the Technical Chemistry Department, on "Artificial Nitrates," with demonstrations of new electric furnaces, by Mr. E. Kilburn Scott. On Saturday evening the lecturettes were repeated, and there were again demonstrations in the workshops, gymnastic and boxing displays, &c.

Foreign Trade in November.—The following are the electrical and machinery figures given in the official returns for November trade:—

IMPORTS.	*Month of Nov.*	*Inc. or dec.*	*Eleven months, 1913.*	*Inc. or dec.*
	£	£	£	£
Electrical goods, excluding machinery and uninsulated wire	153,990	+ 10,007	1,431,771	+ 111,589
Machinery	563,012	+ 2,710	6,664,162	+ 458,037
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	937,055	+632,646	5,058,207	+1,008,449
Machinery	3,309,266	+393,083	34,070,126	+3,651,688

Wotan Half-Watt Lamps.—On Wednesday afternoon, at the Dalston Works of Messrs. Siemens Bros. Dynamo Works, Ltd., we were present at a demonstration of the firm's "Wotan" half-watt lamps, which are the result of extensive experiments, and are manufactured, under master patents, with drawn-wire filaments. They are suitable for both A.C. and D.C. supplies. A 2,000 C.P. lamp was shown running on the works private supply voltage of 225 volts. The lamps have a novel arrangement of the filament and the bulb is filled with an inert gas. The range of lamps is from 300 to 1,500 watts, and 50 to 240 volts. They will shortly be placed on the market in sizes from 600 to 3,000 C.P., and a large use is anticipated for street lighting and the illumination of large areas where arc lamps now serve. Wotan half-watt lamps will be supplied with Goliath E.S. caps only.

Fatalities.—Ernest Fenbow, a young telephone lineman belonging to Dundee, was killed at No. 3 Pit of the United Collieries, Carfin, near Hamilton, last week. He was working along with another telephone lineman repairing wires, and their operations had caused a live wire to come into contact with a wire fence. Fenbow, unaware of this, put his hand on the fence, and was killed almost instantaneously.

Tyne Electrical Engineers.—The *Newcastle Chronicle* states that Lieut.-Col. Scott, the commanding officer of the Tyne Electrical Engineers, entertained the non-commissioned officers to supper, at the headquarters, Clifford's Fort, North Shields, on Saturday night.

Institution and Lecture Notes.—THE ROYAL INSTITUTION OF GREAT BRITAIN.—Friday evening meetings before Easter, 1914, members and their friends only admitted; the discourse begins at nine o'clock. On Friday, January 23rd, at 9 p.m., Prof. Sir James Dewar, F.R.S., will lecture on "The Coming of Age of the 'Vacuum Flask.'" Other Friday evening arrangements to follow include:—

February 13th.—Prof. J. Norman Collie, F.R.S., on "Production of Neon and Helium by Electric Discharge."

February 27th.—Prof. W. A. Bone, F.R.S., on "Surface Combustion."

March 20th.—Lord Rayleigh, O.M., &c., on "Fluid Motions."

March 27th.—Prof. J. A. Fleming, F.R.S., on "Improvements in Long-Distance Telephony."

April 3rd.—Prof. Sir J. J. Thomson, O.M., &c., on "Further Researches on Positive Rays."

Three lectures will be delivered on Thursdays, March 5th, 12th, 19th, on "Heat and Cold" (modern applications, theory of caloric, heat engines, freezing machines, &c.), by Prof. C. T. Jenkin, M.Inst.C.E.

Dr. J. A. Harker, F.R.S., will give two lectures on Saturdays, February 14th, 21st, on "The Electric Emissivity of Matter" (1. The Metals; 2. Other substances), with experimental illustrations.

On Saturdays, February 28th, March 7th, 14th, 21st, 28th, April 4th, Prof. Sir J. J. Thomson will deliver six lectures on "Recent Discoveries in Physical Science."

INSTITUTION OF ELECTRICAL ENGINEERS.—On Monday the annual dinner of the Students' Section was held. Owing to pressure on our space, the report is deferred to our next issue.

At the last meeting of the I.E.E., the president announced that the Council had elected Alexander Graham Bell an honorary member of the Institution.

At a meeting of the SCOTTISH LOCAL SECTION at Edinburgh on Tuesday last, the paper by Dr. Klingenberg on "Electricity Supply in Large Cities" was read, in the absence of the author, by Mr. W. W. Lackie.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last, a paper was read by Mr. A. R. Everest, entitled "Notes on International Standardisation of Electrical Machinery." The discussion was closed.

At the meeting of the YORKSHIRE LOCAL SECTION on Wednesday last, the paper by Mr. S. H. Holden on "The British Standard Specification for Consumers' Electric Supply Meters," was read and discussed.

FARADAY SOCIETY.—The annual general meeting was held on Wednesday, November 26th, 1913, at the Institution of Electrical Engineers. The following officers and Council were elected to serve for the year 1913-14:—President, Sir Robert Hadfield, F.R.S.; treasurer, F. Mollwo Perkin, Ph.D.; Council, R. Belfield, Dr. H. Borns, W. R. Cooper, Prof. F. G. Donnan, F.R.S., Emil Hatschek, Dr. R. S. Hutton, Prof. Alfred W. Porter, F.R.S., E. H. Rayner,

Dr. R. Seligman, Maurice Solomon. At a special general meeting which was subsequently held, certain alterations in the rules were agreed to by which members of cognate societies, to be determined from time to time by the Council, might be elected to membership without being proposed by a Member and without paying the usual entrance fee.

Institution of Post Office Electrical Engineers.—A paper on the "Elimination of Waste in Telephone Plant and Operating" was read before a general meeting of the London Centre on December 8th by Mr. B. O. Anson.

Junior Institution of Engineers.—At a meeting on Friday last the new president, Sir Boverton Redwood, read a communication from Mr. Albert Vickers, stating that he desired to endow a fund for the presentation each year of a gold medal and a premium in books or instruments for the best paper read by a member, to commemorate the occupancy of the presidential chair during the past year by his friend, Sir Trevor Dawson.

Institution of Civil Engineers.—At the Students' meeting, on Friday last, Mr. H. V. Hutt, B.Sc., read a paper on "The Liverpool Street Extension of the Central London Railway."

British Association.—The Council has made grants of £500 to the Committee on Radiotelegraphic Investigations, and £250 towards the cost of the magnetic re-survey of the British Isles, which has been undertaken by the Royal Society and the British Association in collaboration.

A paper on "The City of Dublin Electricity Supply" was read at the last meeting of the Institution of Civil Engineers (Dublin), by Mr. Mark Ruddle, who said the use of electricity as an illuminant in Dublin had almost reached the stage of being a necessity where health and economy were considered. Doubt, he said, had been expressed whether or not the electric supply scheme of the Corporation would be a financial success, but the figures for 1912 supplied a sufficient answer. In that year there was a net surplus of £11,670 on the trading of the department, and the passage of time had proved that in the electricity supply the citizens of Dublin possessed a valuable municipal property.

A popular lecture on "Wireless Telegraphy," with experiments, was given on Wednesday last week, at the London Institution, by Mr. Richard Kerr.

The London Electrical Masters' Association.—The Association, which has been formed for the express purpose of dealing with workmen employed in the electrical trades, embraces any employer who employs workmen who are eligible for joining the Electrical Trades Union or any other such body, and therefore would comprise all supply authorities, manufacturers, contractors, railway companies, telephone companies, &c. Mr. J. Horace Bowden, the supply engineer for Poplar, is the chairman for the ensuing year, and Mr. Leonard G. Tate has accepted the position of secretary. The first committee consists of:—

Mr. J. Horace Bowden.
Mr. E. R. Radford (Trollope & Colls).
Mr. H. Marryat (Marryat & Place).
Mr. A. R. Phipps (Rashleigh Phipps & Co.).
Mr. W. R. Rawlings (Rawlings Bros., Ltd.).
Mr. L. L. Robinson (Hackney Borough Council).
Mr. H. B. Read (Edmundson's Electricity Corporation, Ltd.).
Mr. H. F. Simon (Electrical Installations, Ltd.).
Mr. F. H. Starling (Blackburn, Starling & Co., Ltd.).
Mr. D. M. Strode (Strode & Co.).
Mr. G. E. Taylor (G. E. Taylor & Co.).
Mr. Duncan Watson (Duncan Watson & Co.).
Mr. L. H. Hordern (Westminster Electric Supply Corporation, Ltd.).
Mr. F. J. Walker (St. James' and Pall Mall Electric Light Co., Ltd.).
Mr. Leonard G. Tate, secretary.

London Electricians' Wages Movement.—The Electrical Trades Union has sent in a demand for an increase of pay to 11d. an hour, and for an accepted code of working rules; the Committee of the "London Electrical Masters' Association" has considered the same, and has sent the following letter to the Electrical Trades Union:—

"Referring to your letter of November 11th, and the meeting held on December 3rd of the 'London Electrical Masters' Association,' the Committee then appointed has discussed the questions referred to and will be prepared to meet representatives of your Union at a Conference to be held during the month of January, if your representatives will agree to the following conditions:—

"(1) That there shall be no stoppage of work or interference with non-Union men now, or while the matter is under discussion; (2) that where any interference has already taken place, the same shall be immediately stopped, and work resumed: and (3) that the rule adopted by most trades as to interference with other trades be included in any agreement come to, namely, no exception shall be taken to the employment or non-employment of a man on the ground that he is, or is not, a member of the Electrical Trades Union. Neither shall any exception be taken to the employment of a man in any other trade on the ground that he is, or is not, a member of a trade society."

L.C.C. Conciliation Boards.—Owing to the inability of Sir Edward White through ill-health to attend the meetings of the Rolling Stock Conciliation Board, Mr. Isidore Salmon has been asked by the Council to act in his place. The fitters and fitters' labourers employed at the Greenwich power station, have asked for an increase of ½d. per hour. The questions have been referred to the Electrical Conciliation Board.

The Palace of Varieties, Manchester.—The Palace of Varieties, Manchester, was re-opened on Friday last by the Lord Mayor. The interior of the theatre has been entirely rebuilt, the central pillars having been removed, and a perfect and uninterrupted view of the stage is now obtained from any seat.

The electrical equipment embraces many novel and interesting features, and the whole of the decorative fittings have been specially designed to harmonise with the decorations of the building. Current is taken from the Manchester Corporation mains, and the whole building is wired on two separate and distinct systems, the auditorium and the stage being in each case independently balanced. The stage lighting consists of about 1,300 lights, aggregating about 40,000 c.p. Six battens and one float have between them about 1,100 lamps. The main switchboard controls the whole of the stage lighting and auditorium proper; a separate panel is provided for feeding the bioscope arcs and stage arcs, current for this purpose being supplied by a motor-generator. The dimming equipment is of the A.E.G. design, such as has recently been installed to a considerable extent in large Continental theatres. It is of the metallic type, and consists of resistances controlled by a bank of levers through the medium of wire ropes running over pulleys fitted with ball bearings. The bank of levers consists of three lines for red, blue and white respectively, each section of each fitting being separately actuated by its own lever with graduated scale. Any combination of the colours and intensity can therefore be obtained, or if desired the different banks of levers can be operated simultaneously by means of worm gears, separate wheels being provided for quick and slow operation. In addition to controlling the stage lighting, provision is made for dimming the auditorium through resistances; we understand that this is the only variety theatre in the country which is fitted with this arrangement. The external lighting consists of 12 arc lamps.

The whole of the electrical work has been carried out to the specification of the consulting engineer to the Variety Theatres Co. (Mr. F. J. Humphrey), the decorative effects being to the design of the architect, Mr. Bertie Crewe. The contractors were the A.E.G. Co., the work being carried out under the personal supervision of Mr. F. W. Joll, manager of the Manchester branch.

The heating is carried out on the low-pressure hot water system, exhaust steam from the Manchester Corporation electric station being used in conjunction with calorifiers. This system has recently been adopted in several buildings adjacent to the generating station. A complete system of vacuum cleaners has been supplied and fixed by the Waygood Vacuum Cleaner Co., London.

Fires in Germany.—The 17 companies forming the Union of Private Fire Insurance Companies (Verband der Privat Feuer Versicherungs Gesellschaften) have for a number of years past made a practice of collecting statistics respecting the damages alleged to be caused through electrical installations. According to the Union's report for 1912, there were 483 fires, as compared with 482 in the preceding year, and the compensation paid amounted to £59,900, and £54,100 in the two years respectively. Out of the total number of cases of fire, 231 were proved to have been due to short circuits, and 139 cases were presumed to have arisen from the same cause, and most of the fires (206) occurred in dwelling houses, villas, &c.

Electric Cooking in L.C.C. Schools.—At the sitting of the London County Council Administrative Committee on December 10th, the Elementary Education Sub-Committee reported that they considered it desirable that an opportunity should be taken in connection with the accommodation for cookery being provided at the Bloomfield Road School, Woolwich, to test methods of cooking by electricity, and they suggested that an electric stove be installed in the centre for one year as an experiment. This was agreed to.

Appointments Vacant.—Chief engineer (50s.); assistant (good jointer), 40s.; assistant shift engineer (30s.); two improvers (10s. each), for Bingley U.D.C. Overhead linesman, for Kirkcaldy Corporation Tramways. Jointer (8d.; 56 hours), for West Bromwich Corporation. Senior switchboard attendant, for Salford Corporation. Three switchboard attendants, for West Hartlepool Corporation (25s. to 30s.). Assistant electrical engineer, for Dundalk U.D.C. (£100). A well-known manufacturer is inviting applications for the position of foreman or superintendent of a battery department. Particulars are given in our advertisement pages.

Inquiry.—The Barlaw Engineering Co., Ltd., inform us that an error occurred in their letter inquiring for a supply of power for a special purpose. The current required was stated as 50,000 amps.; this should have read 15,000 amps.

Sir Wm. White Memorial.—According to the *Times*, the fund for establishing a permanent memorial to the late Sir Wm. White, K.C.B., F.R.S., amounted last week to £1,368. Cheques are to be sent to Dr. J. H. T. Tudsbery, the secretary of the Institution of Civil Engineers.

Strike.—An evening paper states that 160 men engaged at the Pearl Assurance Co.'s new offices in Holborn struck work in sympathy with the electricians, the latter having ceased work because the contractors for the electrical work were employing non-union labour at lower wages.

Charge of Stealing.—At the Greenwich Court, on 3rd inst., four men (named Adams, Smith, Lindsey and Piller) were remanded on a charge of stealing electric cable, the property of the South Metropolitan Electric Light and Power Co., Ltd.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Lancaster T.C. has increased the salary of MR. PATTERSON, superintendent of the electricity works.

MR. SELLARS, at present heating and cooking representative of the West Ham electricity undertaking, has been promoted to the position of superintendent canvasser of the sales department (owing to Mr. Hellaby having obtained an appointment as assistant sales manager at Sunderland) at a salary of £200 per annum, plus a commission of ½ per cent.

MR. G. SOWERSBY, of Watford, and MR. J. E. CHAMBERLAIN, of Canterbury, have been appointed shift engineers to the Watford undertaking.

The Cheltenham T.C. has increased the salary of MR. J. M. ROBB, assistant engineer, from £3 10s. to £3 15s. per week. The Electricity Committee has revised the rates of wages paid to the various employés in the department. In addition to raising the wage of the lower grade employés, the Committee has made some changes as to hours. The charge engineers and drivers, who worked in eight-hour shifts, have been in the habit, ever since the start of the undertaking, of working seven shifts per week. They will now be given a shift holiday once a fortnight. This will necessitate the employment of another man, with a consequent increase of expense, but the Committee feels that it is due to the men that they shall have at least one day off in every 14.

MR. C. CROFTON SLEIGH has left the Rochdale Corporation Electricity Works, and accepted a post with the British Continental Electricity Co., Ltd., at San Remo, Italy.

MR. HOPPER, chief assistant engineer and deputy manager to the Rhondda Tramways Co, has resigned his appointment to take up the position of resident engineer and manager of the Wisbech electric supply undertaking of the National Electric Construction Co. On November 27th he was entertained at a smoking concert, at which Mr. H. J. Nisbett presided. The Porth Hospital Carnival Committee presented Mr. Hopper with a gold-mounted walking stick, in recognition of hard work done in the interests of the Hospital.

MR. H. W. SMYTH has been appointed shift engineer at the Stuart Street station, Manchester, at a commencing salary of £175 per annum, rising to £190 at the end of 12 months' satisfactory service.

MR. H. REDFERN has resigned his position with the Yorkshire Electric Power Co., Ltd., having secured an appointment with the Oldham Corporation.

On Saturday, November 29th, at St. Mark's Church, Plumstead Common, MR. ROBERT BERRINGTON, charge engineer of the Erith B.C. electricity works, and late of the Woolwich B.C. electricity works, was married to Ethel Alice, elder daughter of Mr. and Mrs. R. Rawlinson, of 35, Ancona Road, Plumstead.

Increases of salary just granted by the Nelson Corporation, include the following:—MR. G. R. NAYLOR, electrical engineer and tramways manager, from £180 to £200; MR. JAS. STANWORTH, mains superintendent, from £98 16s. to £104.

The Rochdale T.C. is to be recommended to increase the salary of MR. C. C. ATCHISON, the electrical engineer, by £50 per annum, making his remuneration £500 per annum. Mr. Atchison took the management of the electricity works 13 years ago, his commencing salary being £200.

ALDERMAN SMETHURST is to be presented by the Warrington Electricity and Tramways Committee with a vote of thanks, engrossed on vellum, for his services on the Committee.

Tramway Officials.—MR. D. SMITH, who is known to some of our readers in connection with advertising on the L.C.C. tramcars, was due to retire from the Council's service next March under the age limit. On the ground that his retirement would "cause inconvenience to the public service," Mr. Smith has been asked to postpone his retirement for a year.

On December 5th, MR. YOUNG, traffic superintendent under the Oldham tramways department, who is leaving to take up a similar position at West Ham, was presented by the men at the Wallshaw depôt, Oldham, with a gold albert, and Mrs. Young was given a gold pendant. Mr. Dugdale, the tramways manager, made the presentations. MR. JOSHUA BRIERLEY has been appointed in succession to Mr. Young.

General.—At the meeting of the Stepney B.C., on Wednesday, the Electricity Committee recommended that £100 be given to the town clerk, £50 to the borough engineer, £25 each to MR B. J. BELSHER, the chief assistant engineer, and MR. W. W. T. LYNEX, chief clerk in borough treasurer's department, as annual honorariums for their services after the usual office hours in connection with the electricity supply undertaking.

The *Times* New York correspondent states that, at a meeting of the American Society of Mechanical Engineers, on December 3rd, MR. GEORGE WESTINGHOUSE was presented with the Grashof Medal for having obtained the most important results during the past year in the engineering field.

MR. E. E. ECCLES, who has been appointed assistant general manager of the British Aluminium Co., entertained the workers and their families at Foyers, on the eve of his departure for London.

We are sure that our readers will read with regret and sympathy the announcement, which appears in our "City Notes" to-day to the effect that MR. ROBERT KAYE GRAY has been obliged through ill-health to resign his position as managing director of the India-Rubber, Gutta-Percha and Telegraph Works Co. He has been appointed an extraordinary director of the company, and his brothers, Messrs. C. H. and W. E. Gray, have been appointed managing directors. There is no man in the electrical industry to-day who is more highly esteemed, honoured and admired, than Mr. R. K. Gray, and we do not believe there will be one reader of this note who will not desire to associate himself with us when we express a sincere hope that he may have a speedy recovery.

According to the *Commonwealth Engineer*, MR. E. P. GROVES, the electrical engineer who is to act as chief representative for Mr. Merz during the conversion of the Melbourne suburban railways to electric traction, arrived there in October. Mr. Groves will have complete charge of the carrying out of the undertaking, in accordance with the plans and specifications prepared by Mr. Merz.

The same exchange states that MR. A. SMYTH has been appointed overhead superintendent of the electric supply undertaking of the Melbourne City Council at a salary of £286 per annum.

Will MR. J. BESCHLOSS kindly communicate his address to the Editors?

MR. HENRY COATES, chief sales engineer in the northern districts for Messrs. Ferranti, Ltd., Hollinwood, Lancs., is leaving this company to take up a position in a similar capacity for the United Kingdom with Messrs. Voigt & Haeffner (England), Ltd., Birmingham, and from the beginning of the new year he will be at the firm's London offices and showroom, 22, Queen Street, E.C.

MR. J. MARTIN BLAIR, M.I.E.E., 53, New Broad Street, E.C., has been appointed the London representative of the Record Engineering Co., Ltd., Manchester, manufacturers of petrol and paraffin engines, steam traps, &c.

The *Canadian Electrical News* states that MR. R. W. BRUCE, of London, has been appointed general superintendent and chief engineer of the Canada Electric Co., Amherst, N.S., and will also have charge of the electrical equipment of the Maritime Coal, Railway and Power Co at Joggins Mines. MR. P. WHITFIELD has been appointed electrical superintendent for the town of Battleford, Sask.

MR. H. NIGHTINGALE, chief clerk, Power House, Immingham Dock, was presented with an overmantel and clock on Monday last, from the electrical staff, on the occasion of his marriage to Miss Goodhand, of Elsham. The presentation was made by Mr. James Harris, senior charge engineer.

Obituary.—The death took place at a nursing home in Garstang Road, Preston, on December 4th, of MR. JOHN LEMON, district manager of telephones for Blackburn. Mr. Lemon had been in the service of the National Telephone Co. for 30 years, and was formerly chief clerk in his native city of Belfast. On promotion to a district managership, he was sent to Jersey; then to Barrow in 1900, and to Preston three years later, where he remained until the Government took control. He then went to Warrington as assistant district manager, and remained there for some months, until appointed recently to take charge of Blackburn as district manager, in succession to Mr. C. Remington, who went to Liverpool.

The Berne Correspondent of the *Daily News and Leader* reports that DR. HENRI SIMON, chief of the radiotelegraphic service in the Cantonal Hospital at Geneva, died on Monday, a victim of X-rays. "Dr. Simon was a pioneer in using the rays before their dangers to operators were known and provided against. He had endured many operations and amputations, having lost one arm completely and the other partially."

NEW COMPANIES REGISTERED.

Luminous, Ltd. (132,531).—This company was registered on December 2nd, with a capital of £100 in £1 shares, to carry on the business of advertising contractors and agents, manufacturers of advertising devices, &c., and to adopt an agreement with Raghib-Raif Bey and H. Leitner. The subscribers (with one share each) are:—Raghib Raif, 15, Clifford Street, W., gentleman; Hy. Leitner, 35, St. James's Place, S.W., electrical engineer. Private company. The first directors are Raghib Raif Bey and H. Leitner. Registered office, 1, York Buildings, Adelphi, W.C.

W. T. Clarke & Co., Ltd. (132,534).—This company was registered on December 2nd, with a capital of £2,000 in £1 shares (1,000 6 per cent. cumulative preference), to take over the business of a manufacturing electrical engineer and contractor carried on by W. T. Clarke, at 8, New Oxford Street, W.C., as "W. T. Clarke & Co." The subscribers (with one share each) are:—W. T. Clarke, 217, Albert Road, Alexandra Park, W., electrical engineer; E. A. Sheppard, 62, Tooting Bec Road, S.W., secretary; M. Payne, 23A, Allington Road, Queen's Park, W., electrical engineer. Private company. The first directors are W. T. Clarke (managing director) and M. Payne; qualification, £10. Registered office, 8, New Oxford Street, W.C.

Birkenhead Rubber Co., Ltd. (132,559).—This company was registered on December 4th, with a capital of £1,000 in £1 shares, to take over the business carried on by D. R. Rowlands at 110, Chester Street, Birkenhead, as the "Birkenhead Rubber Co." The subscribers (with one share each) are:—D. R. Rowlands, 20, Hampden Road, Birkenhead, pharmacist; R. J. Gallagher, 110, Chester Street, Birkenhead, rubber factor's manager. Private company. D. R. Rowlands is the first director and secretary. Solicitor: T. Pugh, Birkenhead. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Leonard W. Holmes & Partners, Ltd. (132,598).—This company was registered on December 5th, with a capital of £1,000 in £1 shares, to take over the business carried on by L. W. Holmes and others, to carry on the business of owners of patents, technical advisers, electrical and mechanical engineers, &c. The subscribers (with one share each) are:—L. W. Holmes, M.I.E.E., 48, Great Russell Street, W.C., electrical engineer; H. M. Harris, 48, Great Russell Street, W.C., merchant; P. A. E. Armstrong, A.M.I.Mech.E., 48, Great Russell Street, W.C. Private company. The first directors are L. W. Holmes, M.I.E.E. (governing director), H. M. Harris and P. A. E. Armstrong, A.M.I.Mech.E., &c. Registered office, 48, Great Russell Street, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong Kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £5,500 on October 17th, 1913, of trust deed dated July 1st, 1903, securing £195,000, has been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on November 27th, 1913, of £50,000 debs., part of a series of which particulars have already been filed.

Reason Manufacturing Co., Ltd.—A memorandum of satisfaction in full on January 25th, 1913, of charge dated July 4th, 1912, securing £2,000 and any other moneys, has been filed.

CITY NOTES.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

In their report for the year ending September 30th, 1913, which is to be presented at the meeting to be held at 106, Cannon Street, E.C., on Thursday, December 18th, the directors state that the accounts show, after provision for doubtful debts, a net profit of £51,551. Adding £5,904 brought forward and deducting £12,500, the dividend on the preference shares paid in January and July and accrued to September 30th, and £12,500, the interim dividend on the ordinary shares paid in July, there remains a disposable balance of £32,455, which, after providing for the proposed dividend on the ordinary shares, will leave £7,455 to carry forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share, or at the rate of 5 per cent. per annum, be made to the preference shareholders, and that a dividend of 10s. per share, free of income-tax, amounting to £25,000, making with the interim dividend paid in July a total payment of 7½ per cent. for the year, be paid to the holders of ordinary shares; both these dividends to be payable on January 1st prox. The general business of the company has been fully maintained, but the price of rubber having fallen considerably during the 12 months under review, the difficulty of stocks made with material at a higher price than that now ruling has had to be met. The trading of the French factory and some of the company's foreign branches has not made the progress which had been anticipated. There has been a considerable falling-off in the amount of submarine cable manufactured, but the company's steamers have been well employed. The *Silvertown* returned from Australia in May, and in September laid a cable between England and Denmark. The *Dacia* has been engaged in the repair of an Atlantic cable and in work off the coast of Morocco. The *Buccaneer* has been twice to the West Coast of Africa, under charter to the French Government. The works at Silvertown have been efficiently maintained, though one or two of the buildings have been affected by the subsidence of the land through the draining caused by the excavations for the Albert Docks extension. Those who are responsible will, however, be held liable for any damage which results. The board much regrets to state that the managing director, Mr. Robert Kaye Gray, has been obliged through ill-health to resign his position. He has been appointed extraordinary director, so that the business will still receive the benefit of his advice. His brothers, Mr. C. H. Gray and Mr. W. E. Gray, have been appointed managing directors. Mr. Nigel Hanbury has been appointed a director of the company.

Melbourne Electric Supply Co., Ltd.

The directors' report states that during the year ended August 31st, 1913, they cancelled the £250,000 6 per cent. second debenture stock created in 1911, but not issued, and created instead 5 per consolidated debenture stock, limited to £500,000, or the amount of the company's issued share capital, whichever may be the greater, but to be inclusive of the outstanding amount of the 5 per cent. first mortgage debenture stock. £100,000 of such consolidated debenture stock was offered for subscription at 93½ per cent. in March last, the whole of which was allotted and is now fully paid. The area of the suburban districts in Melbourne covered by the company's statutory powers is approximately 74 square miles; and a supply is now available in 410 miles of streets, being an increase of 106 miles during the year. 4,875 new consumers were connected to the mains during the year, bringing up the total number connected to 13,571, being an increase of 56 per cent. as compared with the previous year. The power supply has increased by 28 per cent., the electric motors now connected being equivalent to 9,581 H.P.; the total connections, including lamps, motors, heating and other apparatus, have increased by 38 per cent., and the total units sold by 37 per cent.

In accordance with last year's report, the sum of £10,287 has been applied during the year in writing off certain items in the Melbourne and Geelong capital accounts, and the latter now stand as follows:—

	Expenditure at Aug. 31st, 1912.	Further expenditure during the year.	Amount written off.	Net expenditure at Aug. 31st, 1913.
Melbourne	£553,399	£140,154	£6,512	£687,041
Geelong (including the tramways)	127,195	19,875	3,775	143,296
Total	£680,594	£160,029	£10,287	£830,337

The continued expansion of the company's business will in due course require the provision of further capital, a statement in regard to which will be made at the meeting on Monday, December 15th. The profit and loss account shows that the gross profit derived during the year from the Melbourne and Geelong undertakings amounted to £77,092, as compared with £56,272 for the previous year, being an increase of 37 per cent. After payment of debenture interest and management and general expenses at the London head office, and after making the following allocations, viz.:—To first debenture stock sinking fund, £2,500; to income certificate service fund, £1,800; to general reserve (raising the latter to £60,000), £5,000; to suspense account, to meet the cost of writing off sundry items of plant at Melbourne, £5,000; to amount written off the cost of the recent issue of consolidated debenture stock, £5,780; to writing down head office furniture, £50,—there remains a credit balance of £39,930, plus £5,085 brought forward, making a total credit balance of £45,016. Deducting from this sum the dividend on the 7 per cent. first cumulative preference shares for the half-year ended February 28th, 1913, and the interim dividend of 4 per cent. on the consolidated ordinary stock paid on June 2nd, 1913, there remains an available balance of £27,766. The directors recommend the dividend on 30,000 7 per cent. first cumulative preference shares for the half-year ended August 31st, 1913 (paid on September 1st, 1913), requiring £5,250, and a final dividend of 6 per cent., free of income-tax, on £300,000 consolidated ordinary stock, making 10 per cent. for the year, £18,000, leaving to be carried forward, £4,516. The following tables show the progress of the Melbourne and Geelong undertakings:—

Date.	Consumers.	Lighting in K.W.	Motors in rated H.P.	Total Connections in K.W.	Total units sold.	Gross profit.
Melbourne—						
August 31st, 1911	5,076	5,680	5,196 H.P.	10,668	5,099,162	£33,296
August 31st, 1912	8,696	8,282	7,453 H.P.	15,735	7,082,871	£50,181
August 31st, 1913	13,571	12,189	9,581 H.P.	21,720	9,740,114	£68,281
Geelong (including the tramways)—						
August 31st, 1911	884	1,138	1,133 H.P.	2,225	506,267	£3,206
August 31st, 1912	1,099	1,453	1,380 H.P.	3,049	753,601	£5,990
August 31st, 1913	1,456	1,784	1,846 H.P.	3,580	1,034,052	£8,511

Important modifications have been made in the scale of charges for the supply of electricity for power purposes, which it is anticipated will lead to an increased demand from manufacturers and others.

Stock Exchange Notices.—The Committee has ordered the undermentioned security to be quoted in the Official List:—

Urban Electric Supply Co., Ltd.—Further issue of £126,697 4½ per cent. first mortgage debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Electrical and Industrial Investment Co., Ltd.—£100,000 4½ per cent. debenture stock and £100,000 5½ per cent. debenture stock.

London Electric Railway Co.—86,508 ordinary shares of £10 each fully paid, Nos. 1 to 86,508 (renewed special application).

Underground Electric Railways Co. of London, Ltd.—Further issue of £76,000 4½ per cent. bonds of 1933 of £100 each, Nos. 16,688 to 17,447.

Power-Gas Corporation, Ltd.—The directors recommend that for the year ended September 30th a dividend of 5 per cent. per annum upon the ordinary shares, leaving to be carried forward £3,549.

International Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. upon the preference shares for the quarter ending December 31st.

Manila Electric Railroad and Lighting Corporation—The directors have declared a dividend of 1¾ per cent. ($1.75 per share), for the quarter ending December 31st, on the common capital stock.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended September 30th last of 2s. 6d. per share.

Automatic Telephone Manufacturing Co., Ltd.—The transfer books will be closed from 17th to 24th inst., both days inclusive, for the purpose of preparing the warrants for the dividends on the 6 per cent. preference shares for the six months ending December 31st.

Prospectus.—*Compania de Electricidad de la Provincia de Buenos Ayres, Ltd.*—The list was to close on Wednesday in an issue of 175,000 7 per cent. cumulative participating preference shares of £1 each. The shares are issued for the purpose of discharging the floating indebtedness of the company incurred by mains and plant extensions, and for meeting additional expenditure to which the company is committed.

Globe Telegraph and Trust Co., Ltd.—The directors have declared a quarterly dividend of 2s. per share, free of tax.

Western Telegraph Co., Ltd.—The directors have declared the first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1914, being at the rate of 6 per cent. per annum.

National Telewriter Co., Ltd.

The fourth ordinary general meeting of this company was held on December 4th, at Cannon Street Hotel, E.C., Sir John George Craggs presiding.

In moving the adoption of the report, which showed for the year ended June 30th last an improvement of £3,500 for the year, and expressed the hope and expectation "that, as the current expenditure is now met by the current income, the future results will be more commensurate to the importance of the invention," the CHAIRMAN said he hoped the shareholders would regard the progress made during the year as satisfactory. The expenditure on capital account during the period on instruments, construction, exchanges, plant, &c., was £4,914, as against £5,651 for the previous year, whilst the amount carried to suspense account on the year's working was £854 as against £4,345 for the previous year, an improvement of about £3,500. The total of the minimum rentals provided for in their contracts was £5,765, as compared with £3,066, for the previous period, an increase of about 88 per cent. for the year. The apportionment of rentals carried forward to next year was £1,975 as against £1,463. That was an encouraging rate of advance. Since the date of the balance sheet they had secured a fair amount of new business. This, coupled with the fact that a great part of the contracts secured during the year were carried forward, satisfied him that at the present time their income balanced the working expenditure, and he was looking forward with some confidence to the next meeting, when he hoped to announce profitable results. The improvement in the profit and loss account of £3,500 was 3¼ per cent. on the whole of the preferred ordinary capital issued. If this increase was maintained or improved upon, as they hoped and expected would be the case, they would see that in the near future, now that the revenue balanced expenditure, they would be in the happy position of having profits to divide. Where conditions of working were normal, the instrument was giving the utmost satisfaction, but the conditions they had to meet were not ideal. Some of them might be surprised to learn that there were thirty-two companies supplying electricity in London with no less than thirty-six variations in the supply, such as direct current with a wide range of voltages, alternating current with an even greater variation in voltages and periodicities, all of which necessitated the employment of additional apparatus of special character. Notwithstanding those extraneous difficulties they were going ahead satisfactorily, and had been able to reduce their several types of instrument to one standard machine available for either exchange or private line operations. The Walbrook and Charing Cross public exchanges were proceeding satisfactorily, and the Liverpool Exchange, foreshadowed at the last meeting, was now an accomplished fact. There was evidence of a considerable demand for public exchange facilities in Liverpool, particularly among cotton brokers, to whom a saving in time in the transmission of telegrams, cables, and other messages, was of very great importance. Active canvassing was now in progress, and it was hoped at an early date that the Liverpool Exchange would be placed upon a sound commercial footing, when they could turn their energies to Manchester and establish an exchange in that city. They had, for some time, had instruments in operation between Liverpool and Manchester, which had proved the success of trunk working over that distance, and, when the Manchester Exchange was opened, they would be in a position to meet the demand which existed for inter-communication by Telewriter between the two cities. He mentioned at the last meeting that they had concluded an agreement with the Liverpool Cotton Association whereby the Telewriter was to be employed for the simultaneous transmission of prices and other news from the Cotton Exchange to its members. This service had proved to be highly satisfactory, and was growing in popularity, about sixty machines being now in active employment in the members' offices, all operated by one transmitter situated inside the exchange. The success of this installation had created a lively interest in the system both in Liverpool and Manchester. Negotiations were now on foot for the establishment of a similar service in Manchester operated from the Manchester Royal Exchange, for which official permission had been granted, and there was already evidence of a good demand for such facilities amongst the cotton brokers and spinners in the Manchester district. They also had hopes of introducing a similar service at one of the important commercial exchanges in the City, as well as another service for the dissemination of advertisements and news from a central point throughout London. Dealing with the wide range of uses to which the Telewriter could be put, the Chairman said that many of the important drapery houses and stores in the West-end used the instrument for the purpose of sanctioning credits. In several cases the instruments were used in banks for a like purpose; in the United States there was a large use made of the instruments by bankers. Another service which was becoming popular was the transmission of orders from the telephone clerk direct to the department concerned, and simultaneously to the cashier who authorised execution. They were told that this system saved hours in the despatch of orders, apart from economising in the staff. The public Telewriter exchanges in London and Liverpool were principally used by subscribers for the despatch and receipt of telegrams to and from the post office. Something like half-a-million telegrams per annum were now dealt with by this system, and the appreciable saving in time effected was fully recognised by their subscribers, apart from the convenience afforded and the fact that messengers were dispensed with. The particular use which they were endeavouring to encourage was inter-communication between subscribers for the ordering of goods in writing without the delay of sending a letter or paying the wages of a messenger. As the shareholders were aware, the company had a number of patents in connection with the Telewriter. The earliest one would in the ordinary course have expired this month. The directors deemed it desirable to apply for an extension and took the necessary steps. He was pleased to be able to inform them that they were able to satisfy the court that their claim was reasonable, and the judge granted an extension of five years. There was something in hand just now which might add considerably to the fortunes of the company, but as the matter was not yet complete and would be the subject of a patent, his tongue was tied at the moment. He only mentioned it so that they might know that they were going ahead not only in the accounts as presented, but also in developments for the future.

Mr. E. W. WYNN EDWARDS seconded the motion, and said he did not think he was too optimistic in saying that now the company's revenue met the income, it would not be very long before the shareholders would receive a dividend upon their investments.

The report was adopted.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

Mr. A. R. Monks (chairman) presided on December 4th at Winchester House, E.C., over the ordinary general meeting of this Company.

The CHAIRMAN, in moving the adoption of the report (ELEC. REV. p. 928), said that on the debit side their capital and their debentures remained the same. They had reduced their creditors by some £3,400, that being practically the payment of a large account for cables. On the other side they had expended four items amounting altogether to £3,669; made up of £222 for additional rolling stock, £1,093 for additional machinery, £89 for a new sub-station, and £2,209 for electric light installations. These items had been paid out of revenue for reasons that he would deal with later. On the revenue side there was a total increase of £4,123. The result of the traction department was £2,291 better than last year. This was attributable to better weather and of course the visitors stayed longer in September. With respect to their tramway traffic, they had had to meet some competition from omnibuses and with a view to obtaining certain experience the Directors hired two buses on which they had made a profit of £348. The lighting he was pleased to say had again increased by £1,400; and again they were indebted to the zeal and ability of their manager, Mr. Ford. The expenditure had increased by £2,256. Fuel had undergone an increase of £211, coal having gone up 2s. 6d. a ton; but they had generated 138,000 more units; they had changed the wheels of their rolling stock from chilled iron to steel, and there were also increases in salaries and wages, insurance, etc. Interest had also been greater owing to the higher bank rate. Last year he told them they had contracted for the delivery of a Diesel engine in June, but he was sorry to say that when delivered it was far from satisfactory. However they came to an agreement with the contractors for cancelling the contract and the contractors paid them a sum of money which left them without a penny loss. In fact they made a gain. In addition they generated nearly half a million units with the engine, at the cost of about ½d. per unit. They were disappointed with the engine but it was only fair to say that the Diesel Co. met them fairly and reasonably over the matter. They then determined to go back to steam plant and they had ordered a turbine, generator, condenser, cooling tower, superheater and accessories for delivery in June, all of which would entail a cost of about £9,000; and they hoped this would get them out of their difficulties. They hoped that with the economies the turbine would effect and the increased lighting, they would be in a better position when he met them next year. They had an available balance of £16,607 and they proposed to pay a dividend of 3 per cent. on the preference shares (absorbing £4,500), place £2,000 to the rolling stock reserve account, appropriate £6,000 towards future maintenance of permanent way, add £1,000 to third party insurance reserve, and carry forward £3,108.

Lord ARTHUR BUTLER seconded the motion.

Mr. LEE SMITH said he took it that if the Diesel engine supplied had been satisfactory the Company would not have made the economies anticipated. In other words whilst coal had gone up in price in his opinion it was likely to come down, whereas oil had gone still higher in price than coal and was not likely to decrease.

The CHAIRMAN thought Mr. Lee Smith was fairly right in his observations. The engine might have produced the results anticipated, but they were bound to move with the times.

Mr. LEE SMITH said he was not objecting to the action of the Board but he thought they were well out of it. When the Company ordered the Diesel engine he believed oil came

out at about half the price of coal, now oil cost considerably more than coal, so he thought the Company had scored.

Mr. Waldron asked how the Board were to pay for the turbine.

The Chairman said they proposed taking it out of revenue and the balance would come out of the current year's revenue.

Mr. Waldron pointed out that the arrears on the preference shares now amounted to 30s., and suggested that it would be well if the Board brought forward a scheme for capitalising the arrears.

The Chairman said they had had that in their mind but they did not propose to deal with it for a year or probably two. He did not see how the preference shareholders could well be asked to capitalise the arrears seeing that in a few years they would get it all. The Board had considered the idea of capitalising the arrears and writing down the ordinary shares.

Mr. Lee Smith said he thought if the preference shareholders were brought together they would come to some arrangement with regard to the arrears.

Dr. Moody hoped the Board would not be in too great a hurry to bring forward a scheme of reconstruction. He hoped soon they would get 5 per cent. on the preference shares, and when they reached that happy stage then would be the time to bring a scheme before the shareholders.

The Chairman said he rather agreed with the last speaker. They could hardly induce the preference shareholders to give up much till they got on the 5 per cent. basis which he hoped would be in 1916.

The motion was carried.

Mr. H. Brown in proposing the re-election of the Directors said they would use the money they should have paid for the Diesel engine for the purchase of the turbine, but instead of getting 400 k.w. they would get 1,000 k.w., and that in ordinary circumstances should carry them on for four or five years. They ought to be able to pay for the plant out of this year's revenue, and then the following year the surplus revenue could be at the disposal of the Company for increasing the dividend or building up the reserve.

The motion was carried.

Burmah Electric Tramways and Lighting Co., Ltd.

The directors' report for the year ending the 31st July, 1913, states that the total gross receipts amount to £18,949, and the expenditure under all heads to £11,374, leaving a balance of £7,575. Out of this there has been transferred to reserve for depreciation account £5,000, against which account will be charged the cost of the installation of a second Diesel set, referred to below. This leaves £2,575 plus £1,333 brought forward, giving an available balance of £3,908, out of which it is proposed to pay a dividend on the preference shares at the rate of 3 per cent., absorbing £3,000, leaving £908 to be carried forward. The receipts for traffic, lighting and power, amounting to £18,665, show the satisfactory increase of £2,385 over the previous year. Writing, however, with reference to the increase in traffic receipts amounting to £1,850, the manager comments as follows:—

> The principal factor in the uniformly good receipts obtained during ten months of the year was undoubtedly the general healthiness of the town, which enjoyed not only complete immunity from plague, but comparative freedom from any epidemic. This state of affairs, by restoring confidence in the town and districts, greatly improved trade all round, the bazars and tramways participating. So favourable a conjunction of circumstances cannot, however, be reckoned on, nor can it therefore with confidence be presumed that receipts will continue to expand in the same remarkable manner, the expansion noted being apparently due more to extremely favourable trading conditions than to a natural growth. It appears, therefore, that the presence of similar conditions is necessary to a continuance of the high level of receipts secured.

As regards the expenses, the power costs show a reduction of £1,610, due to the working of the Diesel engine set, which has been running in a satisfactory manner. It has, however, been necessary or expedient to use the steam set as a stand-by from time to time during the year, and latterly to help the peak load during holiday traffic, with consequent extra cost, and it is with the object of obviating this and providing for an increased output that an order has been placed for a second Diesel set, provision for the cost of which has been made in the accounts. The directors consider that the company is now established on a sound financial basis, and will be in a position to make regular payments of part of the dividend on the preference shares. Under these circumstances the directors think it advisable to readjust the dividend rights on the preference shares, and with this object a scheme has been prepared.

Our report of the annual meeting will appear in our next issue. The directors withdrew their scheme.

Alldays & Onions Pneumatic Engineering Co., Ltd.

—For the year ended August 2nd, the directors report that the result of trading (after providing for depreciation and all other outgoings) is a net profit of £18,436, plus £20,097 brought forward, making £38,533. The dividend for the year is 5 per cent., and there is also a bonus of 5 per cent. per annum paid. There is transferred to reserve fund for contingencies and equalisation of dividends, £10,000, leaving to be carried forward £17,443.

Adelaide Electric Supply Co., Ltd.

The ninth annual meeting was held on Monday at the offices, Finsbury Pavement House, E.C., Mr. J. B. Braithwaite presiding.

Before proceeding to move the adoption of the report (see Elec. Rev., page 926), the Chairman formally proposed a resolution increasing the capital of the company from £400,000 to £500,000 by the creation of a further 20,000 6 per cent. cumulative preference shares of £5 each. This resolution having been carried unanimously, the chairman in asking the meeting to adopt the report, said the directors again had the satisfaction of meeting the shareholders with a report which he hoped they would consider satisfactory. The figures which were given constituted very remarkable progress during the year. That progress alone was, he thought, sufficient proof of the energy with which they had endeavoured to discharge the duty which fell upon them under their Act for the supply of electricity throughout the 155 sq. miles of the area which their powers covered. He did not know of any English concern that could show progress of a similar character. The results reflected very great credit on their officers in Adelaide, both technical and commercial, and was also a testimony to the active interest which the local board in Adelaide were taking in the development of the company. Wherever possible it had always been the policy of the board to reduce prices, and last year important modifications had been made in the scale of charges for electricity for power purposes, which the directors anticipated would lead to a largely increased demand from manufacturers and others. It had always been their desire to avail themselves of every possible opportunity for popularising electric supply by reducing prices to their customers where it could be done without injuring the company. They would readily understand that in South Australia they were somewhat handicapped in their capital costs by the necessarily heavy duties which they had to pay on various items, which in some cases brought their costs up to 30 or 40 per cent. more than the same material would cost them here. That was a point which could not be lost sight of when comparing the prices they charged for electric current. Obviously the prices they charged depended upon two points—first, upon their capital cost of installation, and secondly, the cost of generation. He had shown them how they were handicapped in regard to the first point, and as regarded generation, they were faced with the absence of a good supply of water for condensing purposes, which obliged them to use cooling towers. In spite of these drawbacks, they had succeeded in making a very large increase in their business, and in making reductions in the price of current. They were hoping, as opportunity offered in the future, to make further reductions in prices. During the year they had spent £118,000 in developing the business. The ordinary shares, which last year stood at £150,000, had been raised to £200,000, and since the conclusion of the financial year they had raised the ordinary capital to £250,000, the full authorised amount, by a further issue of 10,000 shares of £5 each. In addition, during the year they had sold a further £25,000 of their 5 per cent. debenture stock, and those two items together had supplied them with the additional capital which they had required during the past year, and had gone some way towards providing the capital they would require during the current year. Further capital would be provided by the issue of a further amount of debenture stock probably, and either the whole or part of the 120,000 preference shares, the authority for which they had just obtained. With the expenditure last year, the cost of the undertaking now stood at £603,590. The dividend equalisation fund was intact; they had not had to draw upon it to pay the dividends, and it still stood at £28,000, to which figure it was recently raised. They had raised their carry forward very considerably, and to that extent it tended to secure the position of the capital of the ordinary shareholders and of the new preference shareholders. The table given in the report showing the progress of the company was one which he felt sure the shareholders must view with a good deal of pleasure. They would see that taking the business from 1904 to 1913 the number of consumers had increased from 585 to 11,354; the lighting in KW. from 1,016 to 7,752; the motors, from 677 H.P. to 6,270 H P.; the connections, from 1 667 KW. to 14,022 KW.; and the units sold, from 729,821 to 5,446,488. Those figures illustrated in a most conclusive manner the active way in which the company were endeavouring to discharge their statutory obligations to the people over whom they had powers. Anyone who undertook an inquiry into the way in which they had exercised their powers and the vigour which they had developed their area would, he thought, come to the conclusion that there was nothing to complain of in that respect. The net increase in earnings last year was £12,000, which was fully on a par with the increase in other directions. They had had an advantage during the year of a visit from Mr. Brookman, the chairman of the local board, who had conferred with them on a good many points.

Mr. R. P. Sellon seconded the motion.

The Chairman, in reply to a shareholder, said that the general reserve was invested in the business. It would be foolish to invest that money outside the business for possibly 5 per cent., when they could do so much better by using it for their own purposes. The company did make depreciation, but it would be the greatest possible mistake for them to earmark any specific sum for that purpose in view of the fact that the Government had the right to purchase them any two years.

The report was adopted.

Electric and General Investment Co., Ltd.—A dividend of 1s. per share for the six months ending December 31st is announced.

STOCKS AND SHARES.

Tuesday Evening.

Investment business has not been greatly perturbed nor checked by fresh weakness which developed in Consols, and which caused the price of the stock to fall lower than it has done since 1821, when it was, of course, a 3 per cent. security. Consols are still overpriced, in the opinion of many people, having regard to the change which has come over the value of money. Investment nowadays demands—and receives—4 per cent. with first-class security, 5 per cent. from sound issues, and 6 per cent. from stocks and shares upon which the risk run need not be excessive.

Markets have commenced their last Stock Exchange settlement of the year with buoyancy and a fair amount of activity, dramatic rises in American and Canadian railroad shares setting the pace. In the domestic markets, the settlement of the Great Western Railway dispute in Wales led to a substantial recovery in the prices of Home Railways, the Undergrounds participating to a moderate extent.

Metropolitans and Districts dipped with the rest, to rally sharply on Monday, upon attention being directed to the possibilities held out by the published traffics. It is thought that the Metropolitan will pay an increased dividend over that declared a year ago, when 1¾ per cent. was distributed; and expectation looks for a dividend of 2½ per cent. on District Second Preference, which would be an increase of the fraction. The last-named stock, by the way, is not at present quoted in the Stock Exchange. Underground Electric issues are a little better. East Londons remain at 7¼. London United Tramways Debenture stock has risen a point. British Electric Traction issues are steady, with advances in the 5 per cent. Debenture and the 7 per cent. Preferred stocks.

The strength of the Electricity Supply market is well maintained. County of London Ordinary and City Ordinary show gains of 2s. 6d. and 10s. respectively; an order to buy 250 of the latter company's shares had the effect of stiffening the group as a whole. Holders naturally prefer to keep their shares and await the course of events, which ought certainly to be interesting when the County Company's Bill comes before Parliament next session. Accordingly, the quiet demand which has been stimulated by the publication of the Bill finds little floating supply on offer; and, as a matter of fact, some of the prices are better than might be supposed from the quoted margins.

The Marconi group is better, although the parent shares show no quotable change on the week. There is a disposition to buy the Marconi subsidiary shares once more, on the part of a few hardy speculators. Canadians keep steady about 9s. 3d. Americans rallied to 17s. 9d., Spanish to 8s. 9d., and Marines to 13s. 8d. American Telephone and Telegraph Capital stock has been dull, on the idea that trouble may be brewing in the United States through the possibility of fresh competition, but this was offset by the strength of the American Railroad market, noted in the second paragraph above, the result being that the price of the stock is two points higher at 125. The Telegraph market is disposed to droop, and there has been a little selling of the Eastern descriptions. Eastern Telegraph Ordinary stock fell 2, Eastern Extension shares 1s. 8d., and one or two of the Debenture stocks are a trifle lower. Several deceased accounts are declared responsible for the dulness. Cuba Telegraphs fell 10s. to 8½. West India and Panama reacted ⅛ after their rise, and Reuters went back to 8¾. Anglo-American Telegraph Preferred improved to 105½, and New York Telephone bonds are better at 98. Commercial Cable Debenture and Direct United States Cable shares have drooped

The speech of the American Ambassador at the Savage Club last Saturday night, briefly outlining an unexpected extension of the Monroe Doctrine, has given rise not only to surprise, but to some perplexity, as it opens up new paths, whose turnings may have important results for companies, other than United States undertakings, which have concessions in the areas which the Doctrine is supposed to cover.

The news from Mexico continues to be of the usual conflicting character, but prices of the Mexican group are not fluctuating much at present. Mexican Light and Power Common shares and Mexico Trams second bonds are both a point down, but, on the other hand, the Power Company's Preferred and the Tramways 5 per cent. bonds are both better to a similar extent. Improvements occurred in Rio Tramways bonds. The Anglo-Argentine Tramways issues hardened; and the new issue of Buenos Ayres (Province) Electric Preference shares, advance particulars of which were given here last week, has been notified as being subscribed in full. Brazil Traction shares keep very steady at 89½.

The Manufacturing division is featured by another big rise in Willans & Robinson's 4 per cent. Preference stock, which, at 30, has trebled in value within the last few weeks, the present gain being one of 7½ points; the Debenture is also a little better. Small falls occurred in British Insulated and Helsby shares, Callender's Ordinary and Preference, British Aluminium of both classes, and Edison & Swan fully paid. Consolidated Diesel Engines lost a few pence at 2s. 3d., after the meeting. India-rubber shares dropped 10s. to 13. Prices in the Rubber Share market are still dull and depressed. There has been no advance in the price of the raw material, and until some further development takes place in connection with this, the public are not likely to be attracted to the market. Rumour has it that the methods of the auctions will be changed early in the new year, when monthly inscription sales are amongst the proposals put forward to regulate the price of rubber—these to supersede, of course, the present open auctions, which take place fortnightly.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, December 10th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. .. "	22/-	..
a " Oxalic .. .. .. per lb.	3d.	..
a " Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. .. "	42/-	..
a Ammonia, Muriate (large crystal) per ton	£30 10	..
a Bleaching powder .. .. .. "	£6 5	..
a Bisulphide of Carbon .. .. "	£18	..
a Borax .. .. "	£17 10	..
a Copper Sulphate .. .. .. "	£22 10	£1 10 dec.
a Lead, Nitrate .. .. .. "	£29 10	10/- dec.
a " White Sugar .. .. "	£18	..
a " Peroxide .. .. .. "	£32	..
c Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	3½d.	..
a Potash, Caustic (88/90 %) .. per ton	£22 10	..
a " Chlorate .. .. .. per lb.	3½d.	..
a " Perchlorate .. .. "	4½d.	..
a Potassium, Cyanide (98/100 %) .. " (for mining purposes only)	7¼d.	..
a Shellac .. .. per cwt.	92/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. "	£8 10	..
a " Recovered .. .. "	£5 10	..
a " Lump .. .. .. "	£5	..
a Soda, Caustic (white 70/72 %) .. "	£10 5	..
a " Chlorate .. .. .. per lb.	3½d.	..
a " Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£96	..
b " Wire, in ton lots (1 to 14 S.W.G.) "	£121 6 8	..
b " Sheet, in ton lots .. "	£126	..
p Babbitt's metal ingots .. .. "	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	7⅞d.	..
c " Tube (brazed) .. .. "	9½d.	..
c " " (solid drawn) .. "	8⅝d.	..
c " Wire, basis .. .. .. "	7⅞d.	..
c Copper Tubes (brazed) .. .. "	10½d.	..
c " " (solid drawn) .. "	10⅝d.	..
g " Bars (best selected) .. per ton	£82	£1 dec.
g " Sheet .. .. .. "	£82	£1 dec.
g " Rod .. .. "	£82	£1 dec.
d " (Electrolytic) Bars .. "	£68	£1 10 dec.
d " " Sheets .. "	£86	£1 10 dec.
d " " Rods .. "	£73 10	£1 10 dec.
d " " H.C. Wire per lb.	9d.	⅛d. dec.
f Ebonite Rod .. .. .. "	4/6	..
f " Sheet .. .. .. "	4/-	..
n German Silver Wire .. .. "	1/10	..
h Gutta-percha, fine .. .. "	7/6	..
h India-rubber, Para fine .. .. "	8/0½	⅛d. dec.
j Iron Pig (Cleveland warrants) .. per ton	49/7	4d. inc.
l " Wire, galv. No. 8, P.O. qual. "	£14	..
g Lead, English Pig .. .. .. "	£18 10	7/6 dec.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. .. per bot.	£7 10	..
e Mica (in original cases) small .. per lb.	6d. to 8s.	..
e " " " medium "	8/6 to 6/-	..
e " " " large .. "	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. .. "	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings "	1/1 to 1/8½	..
p " " rolled bars & rods "	1/0⅝ to 1/2	..
p " " rolled strip & sheet "	1/2½ to 1/5½	..
o Platinum .. .. per oz.	185/-	..
d Silicium Bronze Wire .. .. per lb.	10½d.	½d. lo
r Steel, Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. "	£174 to £175	£8 dec.
n " Wire, Nos. 1 to 16 .. .. per lb.	2/5	1d. dec
p White Anti-friction Metals .. per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.) "	£24 15	15/- dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Manx Electric Railway Co., Ltd.—The directors' report for the year ended September 30th, 1913, states (says the *Financial Times*) that the gross receipts amounted to £40,160, and the gross expenditure to £18,740, leaving £21,419 plus £920 brought forward, making together £22,340. It is proposed to pay a preference share dividend in respect of the year, £3,580; to reserve for special renewals, £2,000; and pay a dividend of 2 per cent. on ordinary shares, £2,000; leaving £2,179 to be carried forward. The weather during the past summer was very fine, increasing the passenger receipts by £6,349. Goods and other receipts show a slight decrease. Working expenses amount to £18,740, an increase of £1,071. The ratio of working expenses to receipts was 46·66 per cent. in 1913, as compared with 51·4 per cent. in 1912. The passengers carried during the 12 months totalled 704,188, as against 574,187 last year.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10½	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¾ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8¾ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94 xd	..	4 5 1
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17½	+ ½	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11⅝ — 12½	+ ⅛	4 19 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	103¾ — 105½	+ ½	4 5 3
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅝ — ⅞	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4⅛	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 88	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4¾	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	8 — 8½	+ ⅜	5 6 0
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8⅛	..	4 17 6
Do. 4 % Deb.	Stock	4	4	£0 — £2	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅜ — 5½	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3⅞ — 3⅝	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4½	..	4 12 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	103 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10⅜	..	5 11 7
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	8¾ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6¾ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5⅜	..	2⅜ — 2¾	..	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	97 — 100	..	5 0 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅜ — 1⅞	+ 1/16	5 14 2
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 2
Urban, Ord.	£3	Nil	..	⅝ — ⅞	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 2
Westminster, Ord.	5	10	10†	8½ — 8⅝	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4⅛ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	5 — 5½	+ ⅛	5 14 3
Calcutta, Ord.	5	8¼	5†	7⅛ — 7⅝	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 17 7
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	8	108 — 112	..	7 2 10
Do. 7 % Pref.	$100	7	7	119 — 124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅛ — 11/16	..	7 5 6
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95 — 97	— ½	5 3 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6†	11/16 — 12/16	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103½ — 104½	..	4 15 8
Madras, Ord.	£	Nil	..	1¼ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 — 106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	46 — 50	—	8 0 0
Do. 7 % Cum. Pref.	$100	7	7	81 — 86	+1	8 2 9
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 82	..	6 1 11
Do. 5 % 2nd Mort. Bonds ..	100	5	5	66 — 71	..	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	55 — 62	..	8 1 4
Montreal, Lt., H. and Power ..	$100	9	10†	216 — 222	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	99 — 104	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	£9 — 101	+1½	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	136 —140	..	4 5 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ — 107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	97 — 99	— ½	4 11 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	37/32 — 39/32	..	6 12 6
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6½ — 6⅝ xd	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	124 —126	+2	6 7 0
Do. Collat. Trust	$1000	4	4	88 — 91	..	4 8 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	105 —108	+ ½	5 13 9
Do. Def.	Do.	30/-	..	23⅝ — 24⅝	..	6 3 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7⅞ — 7⅞	+1/16	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	—1	4 18 9
Cuba Telegraph	10	6	6†	8 — 9	— ½	6 13 4
Do. 10 % Pref.	10	10	10	14⅜ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8½ — 9⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6⅞ — 7⅛	..	6 18 0
Direct United States Cable ..	10	4	4†	6¼ — 6⅝	— ⅛	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	124 —127	—2	5 10 8
Do. 8½ % Pref. Stock	Do.	8½	8½	76— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	—1	4 8 4
Eastern Extension	10	7	7	12 — 12⅝	— ⅛	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10⅞ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅜ — 12⅛	..	4 19 0
Great Northern Telegraph ..	20	10	5†	30½ — 32½	..	6 2 8
Indo-European Telegraph ..	25	13	6†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	78 — 82	..	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph ..	1	20	..	8⅜ — 8¾	..	5 14 3
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2 5/16 — 2 11/16	+ 1/16	6 1 0
Monte Video Telephone, Ord. ..	1	6	6	¾ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	1 1/16 — 1 3/16	..	6 3 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	+ ½	4 11 5
Oriental Telep. and Elec. ..	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9½	— ½	10 16 2
Submarine Cables Trust	Cert.	6	6	122½ — 126½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6¼ — 6⅞	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 1/16 — 1 1/16	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	11½	11½	2 5/16 — 2 11/16	— 1/16	4 12 7
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¼ — 10⅛	+ ⅛	5 17 1
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9⅝	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd. ..	10	7½	7	12⅜ — 13⅛	..	5 5 8
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 9th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅜ — ½	..	Nil
Do. 5 % Pref.	1	5	5	8⅛ — 8⅜	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	..	..
Do. Do. Deferred	100	..	..	4 — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	+2	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	+1	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	8	8	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	81 — 83	+2	4 16 5
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1908	100	5	5	94 — 96	..	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	⅜ — ⅝	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2⅛ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	⅜ — ⅝	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ⅝	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	+1	6 7 0
Metropolitan Railway Consol.	100	15	15†	43½ — 43⅝	+ ½	3 14 3
Do. Surplus Lands	100	2⅝	2⅝†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	30⅜ — 31½	+ ½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	⅞ — 1	..	..
Do. 5 % Pref.	1	5	5	⅞ — 1⅛	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	8⅜ — 8⅞	..	Nil
Do. "A"	1/-	..	..	⅛ — ⅜	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord.	5	Nil	..	⅜ — ½	..	Nil
Do. 6 % Pref.	5	3	1½†	3½ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4⅞ — 4¹⅛	..	5 14 8
Do. 2nd Pref.	5	5⅛	5⅛	4⅞ — 4¹⅛	..	6 3 11
Do. 4 % Deb.	100	4	4	90 — 92	+ ½	4 7 5
Do. 4½ % Deb.	100	4½	4½	97⅛ — 99½	..	4 7 0
Do. 5 % Deb.	100	5	5	96⅛ — 98⅛	+ ⅛	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	101⅛ — 103½	..	4 16 7
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	..	6 13 4
Brisbane Trams Invt., Ord.	5	8	8	7⅛ — 7⅜	..	5 8 3
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	114 —119	—1	6 14 6
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 2
Do. 5 % Pref.	100	5	5	102 —105	..	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5⅞ — 6⅛	..	5 17 8
Do. 5 % Pref.	5	5	5	4¹⅞ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	2¹⅜ — 2⅝	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — ⅛	..	N
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4½d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅜ — 1⅝	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅜ — 5⅛	+ ⅛	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	85 — 87	..	5 15 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	78 — 81	..	8 12 10
Do. Gen. Con. 5 % Bonds	..	5	5	81 — 86	+1	5 16 3
Do. 6 % Bonds	100	6	6	82 — 85	—1	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅜ — 6⅛	..	8 0 0
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96½ xd	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅜ — 1⅝	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100—102	+1	4 18 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 91½	+ ½	5 9 3
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	£500	5	5	99 —102	..	4 18 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5⅛	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 8 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	⅝ — ¾	..	8 12 4
Do. 6 % Pref.	1	6	6	5⅞ — 6⅛	..	7 13 4
Babcock & Wilcox	1	16	14†	2¹⅛ — 2¹⅛	..	5 8 11
Do. Pref.	1	6	6	1⅞ — 1⅞	..	4 3 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	—⅛	..
Do. 6 % Cum. Pref.	1	6	6	5⅝ — 5⅞	—⅛	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	7⅜ — 8⅛	— ¼	6 1 3
Do. Pref.	5	6	6	5⅜ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1⅛ — 1⅜	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70⅛ — 75⅛	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85⅛ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10⅛ — 11½	— ¼	6 13 4
Do. Pref.	5	5	5	4⅜ — 5⅛	— ⅛	4 17 7
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	31⅞ — 32½	..	5 3 5
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	67 — 72	..	6 18 11
Dick, Kerr	1	Nil	..	⅛ — ⅜	..	..
Do. Pref.	1	6	6	⅜ — ⅝	..	7 2 2
Edison & Swan, A, £3 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	—⅛	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 6 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	⅜ — 1⅛	..	7 5 6
Do. Pref.	1	7	7	1⅝ — 1⅞	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6⅞ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9½ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12⅜ — 13⅛	..	5 11 1
Do. Pref.	5	4½	4½	4⅛ — 5⅛	..	4 8 11
Do. Deb.	100	4½	4½	100 —102	— ⅛	4 8 3
India-Rubber, G. & T.	10	7½	5	12⅜ — 13⅜	— ⅛	5 11 1
Do. Pref.	10	5	5	9⅞ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 59	+1	6 15 7
Do. B 4 % Cum. Pref.	100	..	..	28 — 32	+7½	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd 1913.

EFFECTIVE WINDOW LIGHTING.

By "WHISTLEFIELD."

Most shopkeepers recognise that a well-lit window is a good investment as well as a good advertisement, but a walk along the main streets of any of our large towns in the evening reveals the fact that the great majority of contractors must have very crude ideas as to what constitutes good lighting; yet this is a point which deserves more attention than is usually bestowed on it, because the matter not only affects the attractiveness of the window display, but has a direct bearing also on the problem of getting the best value from the money expended on light.

Everyone is familiar with the fact that people who walk into a room out of bright sunshine can hardly distinguish anything in the room, though others who are sitting in the room can see everything quite clearly. The reason for this is that the eye automatically adjusts itself to the strongest light that it has to endure. In bright sunshine the iris contracts and the pupil admits much less light than when the eye is subjected to the much weaker illumination of the room, and it takes a few minutes for the eye to adjust itself to the new scale of light intensity.

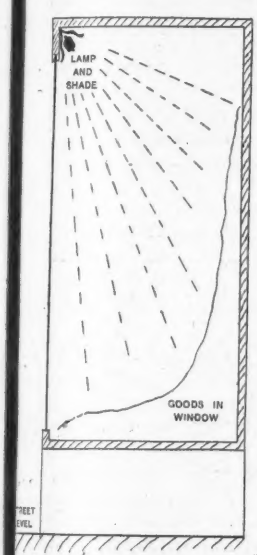


Fig. 1.

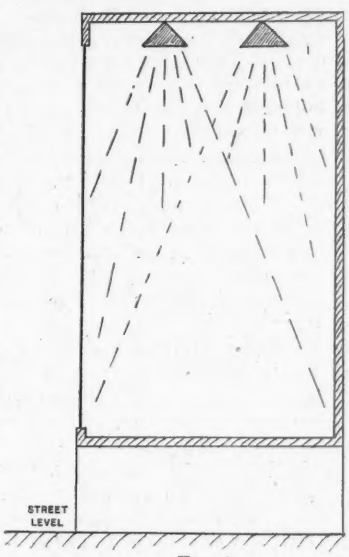


Fig. 2.

Every object has the power, more or less, of reflecting the light that falls on it. This reflected light enters the eye and forms there the image of the object which we "see." The brilliancy of the image depends not so much on the quantity of light which falls on the objects, as on the quantity which enters the eye, and this is governed by the degree to which the iris is opened to admit light. When looking into a window where the lamps are concealed, the eye adjusts itself to the strongest light which is within the range of vision. This will be the light reflected from white goods; should a lamp be introduced among the goods displayed, the eye will immediately adjust itself to the greater intensity of the glow from the lamp, and thus the pupil will be partially closed, and so will admit only one-half or one-third of the light previously admitted. In other words, the objects shown in the window will appear only one-half or one-third as bright as they were before the lamp was introduced into the range of vision, so that there is nothing to be gained by concentrating light on goods in a window, if, at the same time, the glare from the source of light is increased by a corresponding amount, for the greater the glare the more the pupil of the eye is closed, and although the goods actually reflect more light, only a small proportion of it enters the eye, and so they do not appear to be brighter.

When windows are lit by electric glow-lamps there is no reason whatever for lowering the lamps into the range of vision; they ought to be taken right up to the ceiling, and the light should be thrown down on to the goods by means of reflectors.

The arrangement of the lamps and the style of the reflectors used will naturally depend on the nature of the goods displayed, and the method in which they are arranged in the window space. Fig. 1 shows a shallow window with the goods spread out in front, and piled up round the sides and back. This arrangement can be well lit by a few lamps placed in the very top edge where the glass of the window meets the roof, as shown; the lamps in this position are quite out of the range of sight of those who are looking into the window, and suitable reflectors will give an even illumination.

When a window is fairly deep and there is sufficient height for the lamps to remain out of the line of sight, the arrangement shown in fig. 2 can be adopted. Where goods are actually placed against the glass of the window, outside lighting is essential, but suitable reflectors which prevent the light from falling in any direction except that of the window ought always to be provided, as shown in fig. 3.

Fig. 4 shows a very popular method of lighting. A neat reflector fitting is suspended inside the window by chains or cords about 6 ft. above the street level, and lamps are fixed behind the reflectors, which throw the light on to the back and floor of the window; this method is better than that shown in fig. 1 in cases where goods are not spread out flat, and so are liable to have shadows cast by a top light.

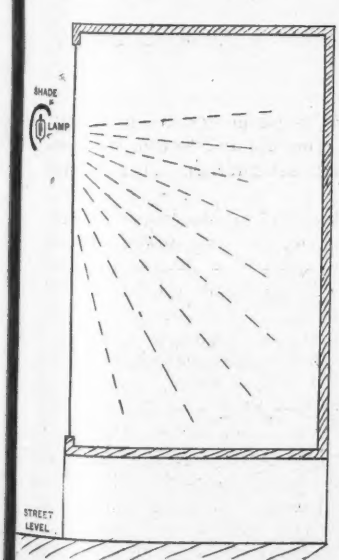


Fig. 3.

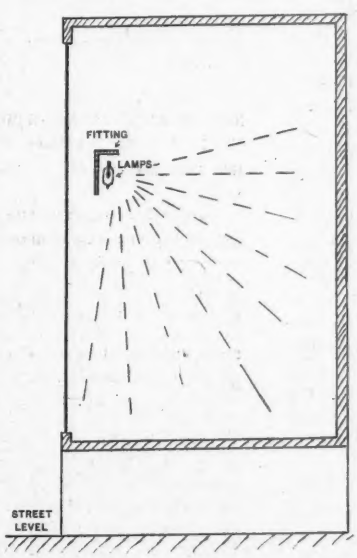


Fig. 4.

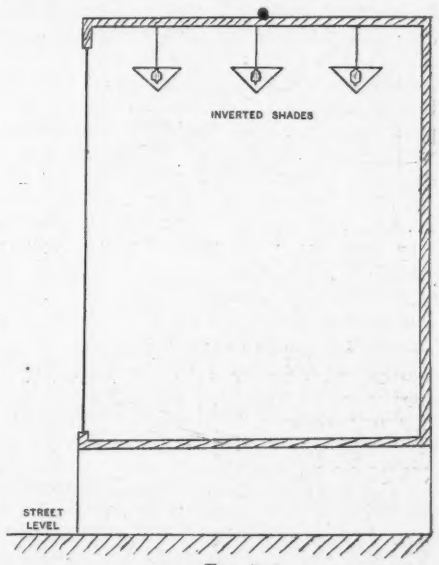


Fig. 5.

Hats which are displayed on stands are best illuminated in this manner. The name of the firm or special notices can be fixed to the front of the fitting, which thus performs the duty of an illuminated sign as well.

Where a very deep window is fitted with costumes displayed on models, or goods of a similar nature, the method of illumination shown in fig. 5 is very suitable; shades are hung below the lamps to throw the light on to the ceiling, from which it is reflected in the form of a shadowless glow, which is extremely effective in the display of light-coloured or delicately-tinted fabrics. When the ceiling is of a good height, the method shown in fig. 2 can be used also, the shadows thrown by the first row of lamps being illuminated by the lamps of the second row, and *vice versâ*. In all these methods of illumination which have just been described, the source of light is either concealed or else placed out of the direct line of vision, with the result that the eye is attracted by the even bright illumination of the goods.

Any windows that are lit by means of pendant lamps can be altered at a trifling cost into one of the styles illustrated by merely raising the lamps to the ceiling and using suitable reflectors.

From the very nature of their design metal-filament lamps shed most of their light in a horizontal direction, and deep shades are needed to deflect the horizontal rays of light downwards, but there are so many good and cheap reflectors on the market that there is really no excuse for a badly-lighted window.

REVIEWS.

Application of Electric Power to Mines and Heavy Industries. By W. H. Patchell. London: Constable and Co., Ltd. Price 10s. 6d. net.

This book, as we are told in the preface, is the outcome of a course of special advanced lectures delivered at the University of London, King's College, last winter, and is undoubtedly the best work that has yet come before us on the very important question of electricity in mines. Its practical nature is due to the author's experience while acting as consulting electrical engineer to the Ferndale Collieries in South Wales.

The book is divided into 12 chapters, the first of which deals shortly with legislation, accidents, field for electricity, &c.; with this we are in complete agreement, especially with the pertinent query: "Why should there be special rules for the use of electricity in mines?" Cables, coal cutters, haulage, electric winding, ventilation, and air compressing, pumping, rolling mills, machine tools and cranes, and electric welding and furnaces, are the chief items in the other chapters; it seems rather a pity that the last three items have been included in a work which is mainly devoted to mining, and we are of the opinion that had what we may term the "iron-works" section been extended and published under a separate title, a useful and interesting work would have been available to those engaged in the important industries concerned. We take it, however, that the work is intended for the use of electrical engineers engaged in designing plant for mines and the heavy industries rather than for the instruction of the engineers and managers engaged in the industries themselves, and we are disposed to think it is the latter who want educating more than the former.

Whilst we have nothing but praise for the book as a whole, we think a little more detail might have been given, in regard to mining, as to costs of generation and operation. The author gives an example showing the cost of endless rope as against main and tail haulage, but as energy is assumed to cost 1d. per unit it is not of much value. The chapter on cables is fairly good, but we are rather surprised that the method of suspending a shaft cable by means of a socket like a "rope socket" attached to the armouring of the cable is not mentioned. Further, one or two methods of installing shaft cables are mentioned by the author, such as "slinging the drum in or under the cage," and lowering with the aid of a locomotive. The proper method is that mentioned by the author on page 36: "To lower the full drum to the pit bottom and raise it into position by means of a good flexible rope." The section on "Earthing" also might be improved, and certainly the use of "old haulage ropes" should be absolutely condemned. In the section on shot firing we read: "Low-tension fuses consist of small platinum wires embedded in fulminate of mercury"; this is hardly correct, as the electric fuse, in both high and low-tension detonators, is quite separate and distinct from the detonator, which is a copper cap containing the fulminate of mercury. The chapter on haulage gears is good, but we are just a little disappointed with "winding engines." The various systems are briefly described, but the diagram of the "Whiting system," on page 138, is not quiet correct, as in the actual system the driving pulleys are set one in advance of the other, and not side by side. Further, at Grand Hornu, there are three electric winding engines, not two; and so far from these being unsatisfactory—as undoubtedly the winder at Preussen II was—they are quite the opposite, and when circumstances are favourable, an ordinary three-phase winder is the best to adopt. The failure at Preussen II was not due to the winder itself, but was unsuitable to the method of caging and the system of generating the current. The main points to be considered in the selection of any type of winder are: effect on generator or supply station, type and weight of drum, method of decking, load to be raised, and at what speed, and these must be considered together. An interesting description of a test with the Ilgner winder at Ferndale Collieries is given; it would have added to the interest if the costs had been included.

Dealing with ventilation, the author discusses the important question of speed regulation; shows the advantages of the cascade motor, and that speed regulation by a resistance for fan driving is not only convenient, but economical. Air compressing is briefly dealt with, and in the following chapters we have pumping, rolling mills, heavy machine tools and cranes, and finally electric welding and furnaces, all of which sections are good, and should prove useful to those interested in these branches of electrical engineering. We regret to notice that Benardos is again spelt "Bernados." The work is well got up, illustrated mainly with half-tones and folding plates, printed on good paper, and is generally a credit to both author and publisher.

Experimental Wireless Stations. By Philip E. Edelman. London: S. Rentell & Co. Price $2.

This book professes to cater for the requirements of wireless telegraph experimenters of all classes, and to embody the results of practical experience and information gained by the author in pursuing experimental work on the subject.

In the first chapter the theory of wireless transmission is somewhat scantily touched upon, but the reader is clearly expected to have a good groundwork of general electrical theory, or else to acquire a knowledge of the fundamental principles from standard works. The chapter forms an introduction to the descriptive and practical parts which follow rather than a serious attempt to expound the principles of wireless transmission.

The practical treatment of the subjects of aerials, grounds, transmitters and detectors is carried out in a way which will, no doubt, appeal to the amateur and render him much real assistance in carrying out the work of installing an experimental station. Clear and adequate illustrations are given freely throughout the book, making it easy to follow the descriptions. The design of simple apparatus for various systems of transmission and methods of reception is treated of, including appliances for fixed spark, quenched and rotary spark gaps, continuous wave transmitters, coupling coils, oscillation transformers, crystal receivers, &c. Practical hints on the construction of measuring and testing apparatus are also a feature of the book.

The author makes the sensible proposal that manufacturers of spark coils should rate these appliances in watts

instead of spark lengths, which convey no adequate idea of their utility for wireless purposes.

Incidentally, it may be pointed out that the signal code given on page 219 shows wrong characters in Continental Morse for the letter F. There are also numerous other misprints and misplaced punctuation marks throughout the book.

The use of the testing buzzer described at the end of Chapter XIV, for actuating and proving the setting of detectors, calls for some comment. Text-books in general fail to indicate the proper connections of this useful appliance to make it give tuned transmission of regulable wave length and small damping when used in conjunction with an adjustable condenser and inductance. A wave meter may readily be fitted with a buzzer in such a way as to effect this purpose. Such a contrivance is always a boon for use in experimental and testing work.

This book will, no doubt, appeal to the numerous class of experimenters who take up wireless telegraphy as a hobby more or less seriously. To them it can be recommended for useful guidance and assistance, at any rate, in the earlier stages of their progress. The practical advice given is generally sound and useful.

Switchgear and the Control of Electric Light and Power Circuits. By A. G. Collis. 1913. London : Constable and Co. Price 1s. net.

This little work deals in a concise and easily understandable manner with the main principles of direct and alternating-current switchgear. In a way it is an introduction to the larger and more comprehensive treatise by the same author, which was reviewed in our issue of September 19th.

The first 50 pages deal in an entirely satisfactory manner with the essential ideas underlying continuous-current switchgear, a considerable number of particular cases being described with the aid of connection diagrams. Considering the limited space available in a small book like the present one, the quantity of genuine information that is incorporated in this section is remarkable.

The remainder of the book discusses in a similar fashion the switchgear and apparatus used for the control of alternating-current circuits. While quite good, it is not quite so detailed as the preceding direct-current section.

At the end of the book is a list of formulæ, which, however, would be of more use if the meaning of the various symbols involved were explained. To an experienced man this definition of symbols would not be necessary, but at the same time neither would the list of formulæ. In several places the author's style is a little curious.

The book contains 85 pages and 47 illustrations, and considering the small price it is very cheap, and should sell in large quantities.—H. G. S.

BRITISH TRADE WITH CANADA.

We have written so much lately on the difficulties of the Canadian market, that it might be thought that we had left little more to say by way of profitable contribution to the study of the British position. We have no desire to overdo the subject in our columns, nor to weary the reader, but when any new suggestion is put forward by those interested in the market that appears to be deserving of full consideration, we do not think our readers' patience will be tried by our outlining it and inviting them to see whether it is worthy of their support.

The proposal to which we wish to refer is fully dealt with in an address which was given before the London Chamber of Commerce, at a meeting held at the end of October, by Mr. J. H. Turner, chairman of the Canadian Chamber of Commerce in London. The whole of the ground covered by Mr. Turner we need not state, for so many of his points are quite familiar to our readers. We will content ourselves with quoting what he believes to be the reasons for the comparative non-success of British traders in the market referred to, and indicating one way in which he and others who have studied the matter believe it to be possible for us to do better in the future.

First, then, let us quote the stated causes of failure :—

(A) So Far as the Consumer is Concerned.

1. Even though quality of goods excellent, design and make unsuitable for Canada—quite a minor detail will often kill the sale of an article.
2. Goods unnecessarily heavily made and packed, thus incurring the handicap of heavy rail transport charges and consequent increase in cost.
3. Owing to lack of advertising, consumer does not know where to obtain British goods.
4. Owing to insufficient representation of British manufacturers, storekeepers do not stock British goods, and they are therefore never brought before the Canadian consumer.

(B) So Far as the Distributor or Storekeeper is Concerned.

1. Cannot get in touch with manufacturers, therefore will not stock goods.
2. Cannot buy British goods that sell ; owing to unsuitability for market.
3. Cannot get goods packed in suitable packages for ready sale according to local conditions.
4. Cannot get catalogues and invoices in dollars and cents.
5. Cannot obtain quotations c.i.f. his city.
6. Cannot arrange suitable terms.
7. Is mulcted in excessive charges for packing, casing, &c.

(C) As Far as the Manufacturer is Concerned.

That owing to the great expense involved—where the actual trade in sight does not appear to warrant it—he is at present unable to obtain the necessary personal, definite and reliable first-hand information and particulars of sales publicity which is absolutely necessary in order to enable him to meet and overcome the difficulties enumerated in A and B ; and, it is in order to endeavour to supply this deficiency that the Canadian Chamber of Commerce now suggests the establishment in Canada of a British Manufacturers' Exhibition Train.

We have lately had an opportunity of discussing this British train proposal with the Secretary of the Canadian Chamber in London (Mr. L. J. Beirne), and from our conversation with him, together with a study of Mr. Turner's address, we are inclined to think that the matter is fully worthy of attention at the hands of all who are desirous that their goods should become known or better known in Canada. It should be said before going any further that Mr. Turner knows the general trade position in Canada from long experience, having been in business in the Dominion for over 40 years. The idea of running manufacturers' trains is, of course, not new ; indeed, it has been applied with great success by Canadian firms themselves in getting their names and goods known in new parts of their own country. The question that now calls for consideration is how far British firms could help to remove the ignorance that exists over there respecting British electrical manufactures, by co-operating in the scheme that is advanced on behalf of the Canadian Chamber in London. The project may be briefly described in Mr. Turner's own words, as follows :—

The manufacturing cities in the United Kingdom shall each hire from one of the Canadian railways a high grade passenger coach—72 ft. × 10 ft. × 10 ft.—such coach to be suitably fitted up with show-cases, window frames, &c., as a travelling exhibition of the products of those manufacturers in each city who are willing to show their goods to the actual consumer throughout the Dominion of Canada ; and who are wishful of entering into commercial relations through the medium of such a train with the distributors of the Dominion. The annual cost for, say, a nine-car exhibition train would be roughly £30,000, this figure to include cost of hire, haulage, maintenance and upkeep, demurrage at stations, lighting and heating, insurance, salaries and wages, steamship and rail fare of employés, advertising, postage and incidental and general administration charges both in Canada and the United Kingdom. It is proposed to meet this annual charge by the letting of exhibition spaces in the cars to manufacturers at rates ranging from £40 to £240 a year, according to space required ; that is, for payments ranging from 15s. 6d. to £4 12s. a week, a manufacturer may place his actual products before both the consumers and the distributors of a continent.

It is proposed that the train shall carry an efficient publicity staff whose work it will be to see that in all cities towns and districts at which the train will be making a stay, the interest of the public shall be fully aroused in advance ; that it shall be met on its arrival by the public functionaries of the place ; and that times shall be suitably arranged for general and trade visitors to separately make a tour of the train and an inspection of the exhibits. A carefully selected staff of expert salesmen would be carried with the train, and there would also be a well-organised system for

the discreet distribution of catalogues to *bonâ fide* trade inquirers. Furthermore, it would be one of the duties of the train staff to keep British manufacturers or their local agents, as the case might be, fully posted regarding the names and addresses of these possible clients. But we need not go into further details at the moment; all we desire to do at this stage is to outline the scheme, to ask that it shall receive the careful consideration that it deserves, and that any of our readers, or electrical organisations, who may be interested, will write for information to Mr. Beirne, the secretary, at the Royal Colonial Institute Building, Northumberland Avenue, W.C.

PRESSURE RISES.

By W. DUDDELL, F.R.S.

(*Abstract of Inaugural Address delivered by the President of the* Institution of Electrical Engineers, *Nov. 13th*, 1913.)

(*Concluded from page* 893.)

If the cable is electrically very short there will be practically no diminution in amplitude or change of phase while the wave progresses along it. This is in general the case for the underground cables and power lines in this country at ordinary frequencies, and under these conditions the cable may be considered to be replaceable by an equivalent arrangement of self-inductions and condensers, as shown in Fig. 14, in which the capacity of each of the two con-

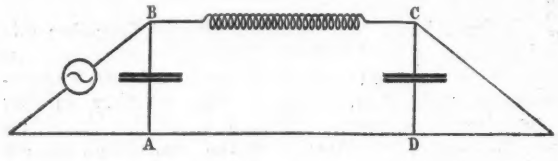


Fig. 14.

densers is equal to one-half of the capacity of the cable, and the self-induction and resistance of the coil between them are equal to the self-induction and resistance of the whole cable..

Very long lines, such as those in use abroad, cannot be considered quite so simply. Suppose a long line is on open circuit at the far end, and, as before, it is suddenly connected to the generator at the zero point of the potential curve. Then the wave of current flows down the line, and when it gets to the open far end it is reflected or turned back on itself and flows back towards the generator; now at this reflection at the far end, the potential difference of the wave is doubled. The wave now travels back towards the generator, where if the generator is assumed to be very large the wave will go to earth quite freely and the reflection will take place with a reversal of phase and no increase in amplitude. The current wave will again travel back towards the far end of the cable where it will again be reflected, and it will travel successively backwards and forwards and so build up to the steady state. Consequently in the steady state of such a cable the voltage of the far end may be looked upon as being built up on a number of components of different phases. The magnitude of the voltage will naturally depend upon the phases and magnitudes of these components, which depend upon the frequency, the length of the line, and its constants. In order that the components may add up to a considerable total it is necessary that they should all arrive at the far end in the same phase, or more accurately that the phases should differ by a multiple of 2π. As the reflection at the generator end is accompanied by a reversal of phase the travel of the wave along to the end and back must be accompanied by a change of phase of π, *i.e.* the alternator must have changed its phase by $\pi/2$ during the time the wave takes to travel along the line, which means that the length of the line is a quarter of the wave-length at this frequency. This condition leads to a building-up of the potential at the end of the line.

Another way of looking at the effect is to consider that the wave which is started flows along the line and after reflection at the open end returns to the generator, where it should arrive at the moment that the alternator has reversed the direction of its e.m.f., so that the returning wave and the e.m.f. of the alternator act in the same direction and assist one another. This effect, namely the building-up of the potential at the far end of the line on open circuit, is generally known as the Ferranti effect, owing to its having first been observed by Dr. Ferranti on the Deptford mains.

In general the velocity of propagation of the wave along the line is less than the velocity of light, say from one-quarter this velocity upwards for ordinary cables and lines, though nearly equal to it for straight wires in space away from other bodies.

At 50 frequency, with a cable having a self-induction of 0.5 millihenry per mile and a capacity of 0.25 microfarad per mile, the velocity of propagation is about 86,000 miles per second in round figures. Hence the distance travelled in one quarter period, or one two-hundredth of a second, is 430, so that the quarter of a wave-length will correspond approximately to 430 miles.

With higher frequencies the length to produce the effect is considerably shorter, so that the effect can become quite marked with the upper harmonics and moderate lengths of circuit, and considerable rises of pressure due to this cause have been observed in the United States. Load on the end of the line reduces the effect, so that on loaded lines it soon becomes inappreciable.

With the higher frequencies employed in wireless telegraphy the Ferranti effect is very marked. Aerials are always adjusted with their added self-induction to the quarter wave-length, so that the potential at the free or open end may amount to some hundred times the pressure employed at their base.

With the short cables in use in this country the effect is rarely observed, but it is of considerable importance from the point of view of sparking and arcing that may take place in switching operations and during faults, which may generate oscillations of a suitable frequency to produce the effect to a very marked degree with comparatively short leads. The magnitude of the effect depends on the resistance being small, which is generally the case in practice.

In making calculations of the frequency which will produce the Ferranti effect on very short lines, the line may be considered to be replaced by the circuit shown in Fig. 14, as pointed out by Dr. Kennelly, and the frequency of resonance of the part B C and D may be calculated by the simple Kelvin formula. A more accurate result can be obtained for short lines of small resistance by taking $2/\pi$ of the capacity and $2/\pi$ of the self-induction of the whole line, and calculating the free period of a circuit composed of a capacity and self-induction having these values.

Some very interesting cases occur when inductive windings are suddenly switched into circuit; for instance, the high-tension coils of transformers, induction motors, or any alternating-current apparatus. In this case there may be no observable pressure rise between the terminals of the coil, but yet during the initial stages the full pressure which is applied between the terminals of the coil may be so unequally divided between the windings as to produce local differences of potential far above the normal.

Let us consider the coil shown in Fig. 15, and let us assume that a high voltage V is suddenly applied to it by means of the switch *s*. Now in the steady state the voltage V will be assumed to be uniformly divided among the turns

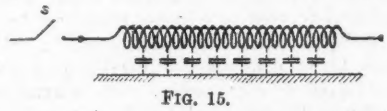


Fig. 15.

of the coil, so that between the ends of the first turn there will be V/n volts, if n is the number of turns. Now consider what happens at the first moment of closing the switch *s*. The current will not instantly attain its steady value; there will be a preliminary stage, and during this preliminary stage one may imagine that a quantity of electricity is travelling forward along the coil from its end. In other words, that there is a sort of wave front starting from the switch to travel along the coil similar to the charge of a long cable. If the coil possessed no electrostatic capacity, *i.e.*, no condenser action, either from turn to turn or from turn to earth, the current would be propagated instantaneously round the coil, and would start to grow from zero in all parts of the coil equally at the same time; but in practice this is never the case, for every coil, however made, possesses some finite though very small condenser action. The wave front therefore takes some appreciable time to travel round the coil, although this time may be exceedingly small. During this progress the potential difference is by no means uniformly distributed along the coil; in fact, the coil may be looked upon as similar to a long submarine cable if one remembers that the electrical constants are very different, and consequently the times of propagation of the disturbance.

In the case of a submarine cable, say an Atlantic cable, if the voltage is suddenly applied at this end, the wave starts off and travels towards the States, and the first trace of its arrival occurs rather less than 0.1 sec. later. In the case of the windings of an ordinary transformer the length of time required for the wave front to travel along the coil is probably less than 1/10,000th of a second. In both cases during the initial stages practically the whole of the potential difference is localized.

The localization of the voltage on the turns of a transformer at the moment of switching it into circuit is of great practical importance and is the cause of many failures. The effect is further aggravated by any sparking which may take place at the switch contacts, which sets up high-frequency oscillations in the leads connected to the trans-

former. As the high voltage between turns due to switching-in only lasts a very short time, too short to be recorded by an ordinary oscillograph, the failure of the insulation between turns may only take place after a number of switchings, when the insulation between turns having been locally weakened, heating sets in at the normal working voltage and a breakdown of the coil to earth soon follows. For this reason extra insulation is often placed on the end turns of transformers, or choke coils are used in series with them as a protection.

High-voltage motor windings are subject to a similar effect, and with asynchronous motors there is a further possible cause of localization of the pressure on a limited number of turns of the windings, not necessarily the end turns. This depends on the fact that the self-induction and mutual-induction of the different sections of the windings are not necessarily equal, owing to the mechanical difficulties in making the short air-gap perfectly equal all round the machine.

The localization effect on the end turns of the apparatus is especially noticeable in connection with the high-frequency oscillations or with the steep wave front currents which may travel along overhead lines after lightning discharges. These are very similar in their properties, but, owing to the much higher voltages which may be induced, much more destructive and difficult to guard against than the steep wave fronts and oscillations that can be set up by switching-on apparatus. This effect has been investigated by Jackson.

Switching-off ordinary loads is generally safe, for even should the switch try and open the circuit when the current has its maximum value it is improbable that the rate of decrease of the current will be sufficient to produce dangerous pressure rises. On the other hand, abnormal currents and short-circuits may give rise to excessive pressure, as the energy liberated at the break is so large that it may form an arc and blow the switch to pieces. If the rate of break is sufficiently rapid to avoid this, the rate of change of the current may be so great that a dangerous pressure rise is produced. A number of valuable records showing the switching-off of large powers amounting to tens of thousands of kilowatts are given in a paper by Maguerre in which practically no rises of pressure are observable, but I think it is unwise to assume that this is always the case. The best means to employ to limit the short-circuit current of generators is one of the problems which face designers at the moment, both to protect the machines themselves from damage and to reduce the risk of pressure rises on opening the circuit.

The whole question of the rate of change of current that may take place at the moment of switching-off is really a question of the suddenness with which the arc or spark between the switch contacts can be extinguished, for except under very exceptional cases it is impossible to break any considerable current without some arc or spark forming at the contacts. The rise due to these causes will, however, be considered in the next sections.

Arcs and Sparks.—Pressure rises may in many cases be traced to the properties which arcs and sparks have of facilitating or causing rapid rates of change of current. The electric arc is one of the few electric conductors which are in general essentially unstable. It is well known that it is necessary to have a steadying resistance or its equivalent in series with any arc in order to reduce the tendency of the current to go off suddenly to infinity or to become zero. This instability of the arc favours the sudden suppression of the current should an arc be formed, and tends to produce pressure rises if there is any self-induction in the circuit, which in practice is always the case. The instability of the arc may be greatly increased if the electrodes are kept cool and close together. A transverse magnetic field also makes the arc unstable. Shunting the arc with a condenser greatly increases this instability, because should the current through the arc decrease due to any accidental cause the potential difference between the terminals of the arc will increase. This will tend to cause the current to flow into the condenser shunting the arc, which current will be diverted from the arc. It should therefore tend to reduce still further the current through it, rendering the conditions more unstable than without the condenser as a shunt.

In my mind the fundamental difference between an arc and a spark is that in the arc the electrodes are being continuously volatilized, and the vapour of the electrodes takes part in the passage of the electric current. The spark, however, is generally of an intermittent or a transitory nature, the electrodes are not appreciably volatilized, and the current is largely transferred through the air. The properties of the spark are more difficult to investigate than those of the arc owing to its transitory nature, but there seems little doubt that they are essentially similar with regard to instability. In fact there are reasons to suppose that the electric spark possesses the same instability as the arc but in an enhanced degree.

Any arcing or sparking taking place in a circuit is liable to set up oscillations which may give rise to dangerous pressure rises. The best-known case is the oscillatory discharge or charge of a condenser such as is used in wireless telegraphy. Fig. 16 shows the usual connections.

If the source of supply is high-tension alternating, each time the condenser charges up to a sufficient voltage the gap S will break down and an oscillatory discharge will take place. This discharge repeats itself each half-wave, or several times per half-wave if the conditions are suitable. If the supply is continuous, current oscillations can still be produced.

A water model can be made which will to some extent indicate the instability of the arc and will give a good representation of how the oscillations are produced. With this model a great many of the properties of arcs both intermittent and oscillating can easily be shown.

Intermittent discharges may take place either with alternating or continuous current, and give rise to oscillations as

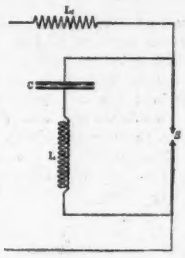


Fig. 16.

follows:—If the generator has a very drooping characteristic, or if L (Fig. 16) is a very high resistance or inductance, then the condenser will take an appreciable time to charge up to the discharge voltage. After the discharge, which may be oscillatory, has taken place a certain time must elapse before the condenser is again charged to a sufficient voltage, so that a regular succession of charges and discharges will take place even with a continuous-current supply. The time to charge the condenser depends for a fixed generator voltage and length of gap on the capacity of the condenser and on the impedance of L, including that of the generator. If the impedance is not too large the successive discharges may follow one another very rapidly. It is possible with a continuous-current supply at very high voltages, and spark-gaps that are well cooled, to make the sparks follow one another tens of thousands of times per second. Probably these intermittent discharges play a considerable part in the production of pressure rises.

The practical applications of the above short résumé of the production of oscillations by arcs and sparks must now be considered. The only capacities available are the capacities of the connections, the network, the feeders, and the windings of the machines to frame. The self-inductions available are those of the windings of the transformers and machines and of the connections, network, and feeders.

Sparks and arcs may in practice be formed at switch contacts or when faults take place. Under normal working conditions sparks mainly take place at the switch contacts, but when large currents are being broken regular arcing is observed at the contacts. In the case of a fault, except a sparking fault to earth with both poles insulated, the discharge at once takes the form of an arc. I have already mentioned that in switching on and off cables on open circuit, pressure rises may be produced should the switch contacts chatter in going in or out. A similar effect can easily be produced by sparks between switch contacts if they are held stationary and almost touching on sufficiently high-voltage alternating circuits. For in this case at the peak of each half-

Fig. 17.

wave a spark will take place tending to charge the cable first in one direction and then in the opposite. These reversals are naturally attended with the pressure rise already referred to under "vibrating contacts." Fig. 17 is a good example of the rises that may be produced when a feeder on open circuit is disconnected, intentionally allowing the switch to spark in air between its brass contacts. The voltage has risen from the R.M.S. value of 2,000 to 5,100 at the last spark before the final break.

When switching off an inductive circuit a high pressure may occur should the current be interrupted suddenly. This well-known effect in the case of continuous-current circuits

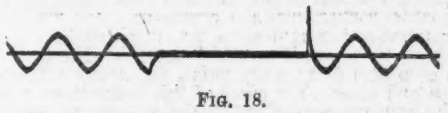


Fig. 18.

can also take place on alternating-current circuits when using oil-break switches, though it is usually supposed not to be the case. It is true that the oil-break switch in general does tend

to open the circuit when the current is in the neighbourhood of the zero value, but this is not always the case. Fig. 18 shows the switching on and off from a 2,500-volt sine-wave machine of a large transformer on open circuit. The oscillograph in this case was connected between the terminals of the switch so as to show the pressure rise at the switch, which amounted at the moment of switching off to 11,000 volts. The rise in pressure lasted about 1/20th of a period, that is to say about 1/500th of a second. It is to be noted that the switch only opened the magnetizing current of the transformer. When making this experiment there was a small piece of cable between the switch and the transformer, and there is no doubt in my mind that the capacity of this cable materially assisted the suppression of the current at the spark, and consequently increased the pressure rise.

I have already mentioned that if an inductive circuit carrying a continuous current be interrupted by a switch, a condenser shunting the terminals of the switch will stop the arcing at the switch contacts and produce a serious pressure rise. The following tests show that a similar effect occurs with alternating currents. A transformer of about 150-kw. capacity was switched on and off by means of an oil switch from the 2,500-volt mains. The measurements were made between the terminals of the transformer. The connections between the switch and the transformer were very short. In this case after switching-off a number of times very few pressure rises were observed. The worst was a peak of 5,500 volts.

On introducing a length of about 60 yards of cable between the switch and the transformer nearly 60 per cent. of the breaks produced pressure rises, the worst of which had a maximum value of 7,500 volts. These two tests illustrate very well the effect of capacity shunting the switch contacts in increasing the tendency to pressure rises when switching-off inductive circuits. It may be said that introducing a cable between the switch and the primary of the transformer does not constitute a condenser shunting the switch contacts, but a little consideration will show that the capacity of this cable to earth is in series with the capacity to earth of the supply main, and that these two condensers in series do shunt the switch contacts; this is the usual arrangement whenever the switch has connected to each terminal a length of cable which has any appreciable capacity to earth.

The arcs which take place when fuses blow have similar properties, and as in this case they are nearly always shunted by the capacity of the cable connected to them, similar rises

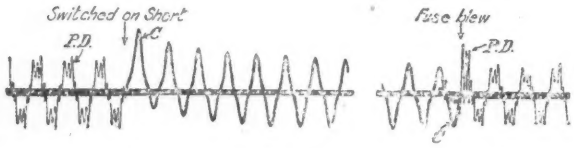


Fig. 19.

take place. Fig. 19 shows a short-circuit on the end of a feeder connected to a 2·000-volt 400-kw. generator which was allowed to remove itself by means of a fuse.

The big initial rush of current and the pressure rise attendant on the blowing of the fuse are clearly shown, the maximum value being 4,200 volts. Another example is shown in Fig. 21, in which a light fuse was suddenly connected as a short-circuit to the secondary of a 10,000-volt transformer; the fuse blew instantly. During the short-circuit the potential difference between the terminals of the secondary of the transformer was of course reduced to zero. This lasted for about half a period, when the fuse melted and a rise in pressure of 27,000 volts was recorded. In this case the great suddenness of the interruption of the current was in part due to the fineness of the fuse used, leaving very little volatilized metal to form an arc, and partly to the capacity of the leads connecting it to the transformer.

Sparking at switch contacts may also set up oscillations along the leads in much the same way as the oscillations are set up in wireless aerials by sparking into them at their bases. The mere sparking into the lead will not in general set up very violent oscillations because these oscillations will have to pass round the generator, but should there be considerable capacity between the generator and the switch contact, oscillations may be set up which will pass through the condenser to earth. In this case the apparatus situated at the end of the lead might be subjected to considerable strain, and might run the risk of having its end turns damaged owing to the high-frequency oscillations set up along the lead.

At high voltages any sparking taking place between one point of an insulated circuit and earth will set up oscillations in the leads, connections, and apparatus. The whole circuit may be considered as equivalent to a complicated aerial system of a wireless transmitter which is excited in the manner generally spoken of as plain aerial, that is with a spark between it and earth. The effect of this is to set up a number of high-frequency oscillations in the system, producing high potentials at all points where reflections of the oscillations may take place, such as open ends and the connections to apparatus having appreciable self-induction. A spark fault to earth may produce very high voltages localized on the end coils of transformers, etc.

I have not yet come across a well-authenticated case in practice of an arc acting as a musical arc and producing dangerous pressure rises. There is a great deal more risk in intermittent arcs maintaining oscillations than from the arc producing continuous oscillations.

The opening of large currents, whether it be by switches or fuses, or by faults which burn out, is always attended by the risk that the current may be suppressed too suddenly and that the energy stored in the self-induction of the circuit may not be dissipated. In this connection I am inclined to think that sufficient attention has not been paid to the self-induction of the leads and cables. Although the self-induction per mile of the cables is comparatively small—it may apparently range from a fraction of a millihenry for cables very close together to some 5 millihenries for conductors like track rails on continuous-current railways—yet the amount of energy that may be stored is considerable owing to the large current that may flow at the moment of short-circuits or faults. It is to be noted that as the great part of the magnetic field is situated in air, should the current be suddenly suppressed the whole of the energy is liberated at once, giving rise to very high voltages. This is not necessarily the case in

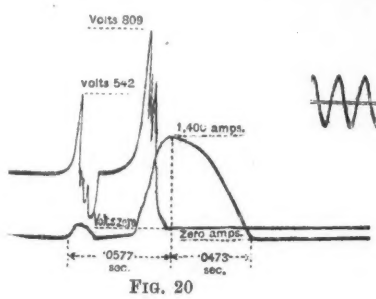


Fig. 20

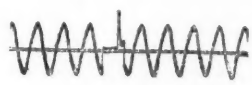


Fig. 21.

machines and apparatus, as with these quite a considerable part of the self-induction may be due to the lines of force threading the iron, and it is impossible for these to collapse so suddenly on to the conductors owing to the eddy currents they would produce in the mass of material; therefore when they do collapse some of the energy is wasted by this means and the pressure rise is reduced.

The self-induction of one mile of two 0.5 sq. in. cables laid in non-metallic ducts at 4-in. centres is about 1.6 millihenries, the capacity about 0.1 microfarad, and the resistance 0.176 ohm. Taking these figures the maximum possible voltage rise neglecting the self-induction of the machine is 252 times the current suppressed, if the cable is considered to be equivalent to localized condensers and a self-induction arranged as in Fig. 14. For 500 amperes interrupted, the limit of the pressure rise might thus be 126,000 volts.

If a short-circuit is suddenly interrupted somewhere in a long cable a high-voltage wave front starts from it and travels in each direction towards the ends of the cable, where it may be reflected if the end is open or connected to a high self-induction, its amplitude being then doubled.

There is no doubt that in many cases of short-circuit whether of a continuous current or of an alternating current—the current is very suddenly suppressed. The arc is quenched somehow, to use a wireless term. In ordinary cases of supply mains there may be two causes which tend to this quenching of large-current arcs. First and foremost, the considerable magnetic field produced by the current itself. Second, and this applies to insulated mains in enclosed spaces, the production of a gas surrounding the arc due to volatilization, and the splitting-up of the insulating material. Third, the cooling effect of the large masses of the metal which are usually present in circuits to carry large currents. Some tests made by Collis show very well the pressure rises that may occur on breaking continuous-current circuits. Fig. 20, taken from his paper, relates to a magnetic-field blow-out circuit-breaker operating on a dead short-circuit, the voltage rising to 809, and the steady value after the circuit-breaker had operated being 226. The arc in this case appears to have been suddenly extinguished, producing the high-pressure rise, and then to have re-started, causing a second but smaller rise.

In order to illustrate the pressure rises that may occur in cables due to short-circuits, I have prepared a model line, representing 10 or 15 miles of cable, in which the self-induction, capacity, and resistance per mile are, roughly, increased tenfold. Consequently the frequency of the line is reduced tenfold. With this line connected to the ordinary continuous-current mains it is possible to make short-circuits anywhere along it and to observe on the oscillograph the attendant pressure rises. The tests made with this line indicate how easy it is to obtain very considerable pressure rises by means of short-circuits which are suddenly opened, and they also indicate the strain at the end of the line due to the reflection at that point of the wave that travels along it each time a short-circuit is removed somewhere along the line.

THE CHARACTERISTICS OF INSULATION RESISTANCE.

By S. EVERSHED, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS *at Birmingham, November 26th, London, November 27th, and Cardiff, Dec. 1st,* 1913.)

(*Concluded from page* 937.)

To experiment with a series of drops and connecting films deposited on any kind of exposed surface would have led to almost certain failure, owing to the difficulty of protecting the films against currents of air. This liability is almost non-existent inside a porous insulator, where any considerable change in the humidity of the air occupies a comparatively long time, and the consequent changes in the films and their resistance are not too quick for experiment. To imitate this condition of moderate stability it was decided to construct a model insulator by drawing a series of drops of water and bubbles of air into a capillary glass tube, so that each bubble should constitute an enclosed region within which a film could form on the internal surface of the tube, and remain there entirely undisturbed by air currents. The glass tube, which was about a couple of inches in length, with a bore of 12 or 14 mils, had its ends bent downwards, so as to dip into water contained in two small beakers. Two copper wires, one in each beaker, served as the electrodes. The complete arrangement, as shown in fig. 18, was fixed under a microscope in

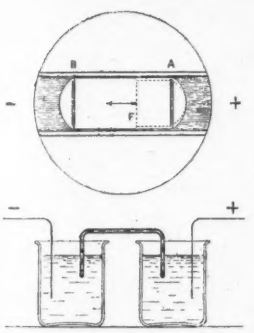


FIG. 18.—ELEMENTARY MODEL OF AN ABSORBENT INSULATOR. THE UPPER FIGURE REPRESENTS ONE OF THE AIR BUBBLES AS SEEN IN THE FIELD OF A MICROSCOPE.

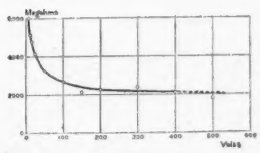


FIG. 19. — CHARACTERISTIC CURVE OBTAINED FROM A CAPILLARY GLASS TUBE FILLED WITH DROPS OF WATER AND BUBBLES OF AIR, AND ARRANGED AS SHOWN IN FIG. 18.

such a position that portions of two adjacent drops, with the whole of the air bubble in between them, came within the field of view, as indicated in the upper part of the same figure. At A and B dark transverse lines, corresponding to Newton's rings, were seen at the end of each drop where the water-air surface approached the glass at a capillary angle. These lines formed convenient gauges for estimating the initial thickness of the film of water deposited on the glass, and it was apparent that in the neighbourhood of the capillary edges of the drops the thickness of the film did not exceed one-quarter of the mean wave-length of light.

To understand the behaviour of this tube it is necessary to have the principle of electric endosmose clearly in mind. When an electrically-charged body is placed in an electric field, it is attracted one way or the other, according to whether the charge it holds is positive or negative, the attractive force being proportional to the potential gradient (volts per centimetre). Water which is lying on an insulator in an electric field will be urged towards the negative side of the field, and will flow in that direction if it is free to do so.

Any liquid would exhibit the phenomena of electric endosmose provided two essential conditions were fulfilled. These are, that the liquid must be either electro-positive or negative to the channel which contains it, otherwise there will be no charge and no force; and its specific resistance must be very high, otherwise it will be impossible to maintain a steep potential gradient inside the liquid without overheating by excessive current.

Water, and especially pure distilled water (or condensed water), happens to possess both the essential properties in a remarkable degree. It is strongly electro-positive to all insulators, and its resistance is such that it is possible to maintain a potential gradient of several hundred volts per centimetre without any overheating by electric current.

Endosmose may be made visible in a short glass tube connecting two water vessels. By contact with the glass the water in the tube acquires a positive charge which occupies a cylindrical layer of water next the wall of the tube, being held there by the corresponding negative charge in the glass surface. When a potential difference of several hundred volts is maintained between the water vessels, the charged water in the tube is strongly attracted towards the negative vessel, and moves in that direction down the potential gradient. This movement is confined to the charged layer and such water as it can drag along with it, and when the bore does not much exceed half a millimetre the whole of the water will be set in motion and may be seen travelling slowly towards the negative end of the tube.

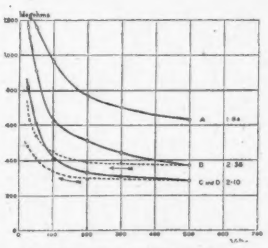
It is not essential to have the water within anything; all that is necessary is that the water should be lying in contact with an insulator and forming a conducting path between two electrodes. Then, if the voltage gradient between the electrodes is steep enough, and the water is free to move, it will find its way towards the negative electrode whether there is any definite channel for it to run in or not. But without some kind of trough or tube the water is apt to go by all sorts of devious ways towards its goal, and the confused motion becomes difficult to follow by eye.

On applying an electromotive force to the electrodes in the two beakers the effect of electric propulsion, or endosmose, was at once apparent. On closing the circuit the surfaces of the two drops visible in the field of the microscope instantly changed their curvature, the positive surface A pushing its edge out towards the negative side of the field of view, and the negative surface B decreasing its curvature by withdrawing its edge inwards. The dotted lines in fig. 18 indicate the general nature of this effect, but grossly exaggerate the extent of the change. If the film connecting the two drops happens to be visible,* every part of it is seen to experience a sudden force pushing it towards the negative side. The effect of the hydraulic pressure produced in the drops by the electric propulsion is seen at the same time; a stream of water is forced out from the edge of the positive drop and flows rapidly towards the negative drop, increasing the thickness of the film as it goes along. The advancing wave front (F in fig. 18) of the travelling water is clearly visible, and if the potential difference is gradually increased, the growing thickness of the now moving film is made apparent by its assuming, one after another, the colours characteristic of thin films.

The sectional area of the films is, of course, exceedingly small compared with that of the drops, and hence the resistance of a complete tube of given diameter is determined almost entirely by the aggregate length and mean thickness of the films, the resistance of the drops being negligible by comparison. The visible increase in the thickness of the film will therefore be made evident also by a concurrent fall in the resistance of the tube, and if a series of tests be made at gradually increasing potential differences the characteristic curve of the tube as an absorbent insulator may be drawn, as shown in fig. 19.

When the electromotive force is cut off, the surfaces of the drops are instantaneously restored to their normal shape. The surplus water in the films then withdraws very slowly into the adjacent drops, until, after a period which may be hours rather than minutes, the films are reduced to their initial thickness and the resistance of the tube recovers its initial value.

A single tube, one capillary channel, could hardly be expected to give a faithful imitation of a real insulator. Much better results have been obtained from models composed of a number of similar tubes connected in parallel, particularly when they have been given ample time to settle down into a normal condition. The three curves in fig. 20 were obtained from a model made up of 13 tubes in parallel, curve A being taken 20 hours after filling the tubes,



A 20 hours after filling the tubes.
B 44 " " "
C 98 " " "
D 113 " " "

FIG. 20. — CHARACTERISTIC CURVES OBTAINED FROM A MODEL INSULATOR COMPOSED OF 13 CAPILLARY GLASS TUBES ARRANGED IN PARALLEL.

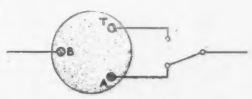


FIG. 21.—GLAZED PORCELAIN BLOCK FITTED WITH THREE ELECTRODES FOR INVESTIGATING THE POLARITY OR "VALVE" EFFECT.

and curves B and C at 44 and 98 hours respectively. In these tests leakage along the external surfaces of the tubes was eliminated by guarding each tube, and in order to ascertain whether the guard wires upset the uniformity of the potential gradient, a fourth curve D was taken at 113 hours with the guard wires removed. This curve so closely follows curve C that to avoid confusion the mean values of the observations in the two tests have been plotted in fig. 20 as a single curve representing both C and D.

Reckoning from the average of these four curves the ratio R_{50}/R_{500} is 2·1, a figure which agrees surprisingly well with the average ratio 2·2 obtained from absorbent insulators.

Hysteresis, which is such a marked feature of the moisture curves of real insulators, is equally characteristic of the model. In each series of tests upon the model the return curve obtained by retracing the voltage steps from 500 back to 25 volts has indicated a pronounced hysteresis effect. The return curves obtained imme-

* The film is only visible when parts of it are thick enough to give some of the colours of Newton's rings. If its thickness is much less than a quarter of a wave length the film cannot be seen.

diately after curves B, C, and D, have been included in fig. 20, and should be compared with the example of hysteresis in real insulators which has been given (as in fig. 2).

The general resemblance of the curves given by glass models to those which are characteristic of absorbent insulators is evident. In the decreasing resistance with increasing voltage, in the extent of the decrease, in the slow recovery or hysteresis, even in instability, the films and drops possess properties which are common to every absorbent insulator. The dormant water which we found in the pad of paper is here in the drops, and the resistance water is visible in the films which link the drops together into a conducting chain, and provide the high resistance.

But in one matter a simple model composed entirely of open tubes differs fundamentally from a porous insulator. The first effect of heating an absorbent insulator is to bring about a very large decrease in resistance. Heat this too simple model, and the expanding air bubbles lengthen the films and increase the resistance.

But, after all, the structure of the model is not much like the real thing. For the tangled maze of interconnected channels in a porous insulator, the model substitutes a number of parallel channels, each going without break from one electrode to the other; it contains no blind alleys and no cross-connections. Hence in the model the proportion of dormant water falls far below the proportion which we have found by weighing the water in the real insulator.

In one tube the thickness of the films was about six millionths of an inch when swollen by the action of endosmose. Hence judging by the concurrent decrease of resistance, their initial thickness must have been about two millionths of an inch. This is so much less than one-quarter of a wave-length of light that in the initial state, the film had no perceptible colour by which to estimate thickness.*

That is to say, for one part of water in the films there are less than 2,000 parts of dormant water. In a real insulator the corresponding proportion is, as we have seen, from five to 50 times as much. To represent reality in this respect it would be necessary to build up a model with a very large number of closed tubes in addition to the open or conducting tubes, and to interconnect the two sets, by numbers of cross tubes.

Heat this complex model and the expansion of the trapped air† in the closed tubes will drive a large volume of dormant water into the conducting channels. At the same time the expansion of the air in the open tubes may have lengthened or even broken up some of the films, but the quantity of dormant water forced out from the blind alleys will be enough to flood the conducting channels, bringing about an enormous fall in resistance. Lower the temperature and the air bubbles throughout the system will contract and the flood water will retire into the blind alleys. The films then slowly recover their initial thickness and the resistance rises to its former value.

The permanence in the shape of the moisture curve has already been referred to, and in view of what has been demonstrated by means of a bundle of capillary glass tubes the explanation is clear. Each film gives more or less the same sort of curve; the curve is characteristic of the film with its adjacent reservoirs of dormant water; the magnitude of the conductance is simply a question of the number of film paths acting in parallel.

The marvellous rapidity with which the resistance alters when a change occurs in the humidity of the air is attributable to the extreme tenuity of the films.

The facts which have emerged from the investigation leave no room for doubt as regards the main characteristics of insulation resistance under working conditions.

The true dielectric resistance of insulation is enormous, compared with the actual insulation resistance obtained in practice, and in all ordinary cases we need only consider the leakage which takes place through films of moisture condensed on the external and internal surfaces of the insulating material. Dielectric leakage is insignificant and may be left out of account.

At what point leakage through moisture becomes dangerous; whether the ultimate effect of prolonged endosmosis is to safeguard the insulation by driving all the water away from the positive conductor in a continuous-current system, and from both conductors if the supply is by alternating current; whether it is possible to predict the breakdown voltage—these and other questions can only be answered by an investigation of the second part of the characteristic curve.

The whole of the experimental work has been carried out at Acton Lane works by Mr. S. F. W. Finnis, to whom the author is greatly indebted for the skill and patience with which the experiments were conducted. The author also wishes to thank Mr. B. Welbourn, of the British Insulated and Helsby Cables Co., for providing samples of paper cables and the oil and paper used in their manufacture, together with data relating to the specific resistance of these materials.

Appendix.

The effect which polarity has on the resistance of some kinds of insulation has been known from the early days of telegraphy in connection with overhead wires run on earthenware insulators. The same effect is frequently met with in testing the insulation resistance of electric light wiring. So far as the author is aware it was first traced to porcelain insulators by Mr. Bernard Holt, of Perth, West Australia.*

House wiring, whether tested from wire to wire with the switches open, or from the wires to earth, often shows a valve effect. Porcelain base switches of inferior quality have invariably acted like valves. On the other hand, switches of the best quality in which well glazed china is used, gave resistances from about 100 megohms up to several thousand megohms.

To ascertain the cause of the valve action, tests were made on a flat block of porcelain of good quality. The resistance being far too great for easy measurement, the glaze was partially removed by grinding in order to approach the condition of an ordinary switch base and at the same time obtain a smooth flat surface. Three small electrodes, A, B and T (see fig. 21), were secured to the surface, and the method of experiment was to measure the resistance of the path A B and compare it with that of the path T B, the region round B being common to both paths. Current was never allowed to traverse the path T B for more than two or three seconds at a time—just long enough to allow the ohmmeter reading to be noted—and hence any substantial increase which might be observed in the resistance of this path would be confined to the neighbourhood round electrode B and would be the result of current flowing in the path A B. It was found that when current, flowing in either direction, traversed the path A B, the resistance of this path gradually rose until by the time the current had been flowing for half an hour or so the resistance would be 20 or 30 times the initial value. By cutting off the current in A B and immediately taking the resistance of the reference path T B, it was at once seen whether the increase in A B had taken place at electrode B or not. In this way it was proved that when electrode B was positive, practically all the increase in the resistance of A B occurred at or near B; and when that electrode was negative then no material change took place there. That is to say, the increase in resistance that results from the leakage current is almost entirely confined to the region round the positive electrode, the conductor where the current enters the earthenware. In one experiment the initial resistance of the path A B was 40 megohms, and on switching on the testing current, which in this instance entered the porcelain at A, the resistance rose to several thousand megohms in the course of two or three minutes. During this time the reference path T B changed from an initial value of 8·0 megohms to a final value of 8·2 megohms. Hence of the enormous increase in the resistance of A B only 0·2 megohm occurred in the region near the negative electrode B; practically the whole increase took place in the region of the positive electrode A.

Much depends upon the size of the electrodes and the area of access to the interior of the porcelain. A complete installation of switches may show no valve effect, because they are coupled up to the wiring without any regard to valve direction. But where there is some systematic difference in access-area the circuit as a whole will show the valve effect. An overhead telegraph line is a good example. At every insulator the line wire, and its binding on the well-glazed surface of the insulator, has a far smaller access-area than the fixing bolt embedded inside the earthenware. Such a line will have a higher insulation resistance to earth when the line is made positive than it has when the polarity is reversed. Electric wiring when tested from circuit to earth will show the valve effect for much the same reason.

The increase in resistance at the positive electrode seems to be due to the clogging of the leakage channels, both the cracks in the glaze and the capillary passages in the body of the earthenware, by the products of electrolysis. The action of endosmose in driving moisture from the positive towards the negative electrode must not be overlooked.

An installation of wiring, which when new may have no valve action when tested from wire to wire, will soon acquire it if the supply is by continuous current. In this case the positive side of every porcelain switch base becomes so clogged by the prolonged electrolysis which goes on whenever the switch is open, that a systematic difference in access-area comes about, the positive terminals in contact with the clogged earthenware acting as the electrodes of small access-area.

The insulation valve is thus seen to be closely related to other well-known electrical valves which depend for their action on the two electrodes having widely different freedom of access to an electrolyte.

Discussion.

Prof. S. P. Thompson, in opening the London discussion, said the paper was a definite contribution to a very unexplored part of their science, and they were particularly indebted to the author for what he called his characteristic curve. He had given them many data and many hints as to what was going on in insulation. As regarded the action of water in porous material, it was surprising how little of it was really taking part in the leakage. It was also a remarkable fact that no chemical compound had been found to impregnate the cellular structure to prevent moisture entering. It was clear that they did not get a constancy in the conductivity unless there were a considerable number of channels; the conduction of current through a liquid was always a phenomenon of lively movement, and the greater number of channels averaged things out. He protested most emphatically against the suggestion that any substance did not obey Ohm's law; it was impossible to expect the resistance to be constant, but this did not affect the law, which was true, unless one put something into it which was not intended.

* The wave-length at the sodium line in the spectrum is 23 millionths of an inch. It is worth noting that at its thinnest the film has depth for about 170 molecules.

† Inside a porous insulator containing a normal amount of moisture the volume of air will vastly exceed the volume of dormant water, and there must be innumerable bubbles of air trapped inside capillary spaces by drops of water.

Mr. C. Beaver said most of the phenomena referred to were familiar to cable makers, who had always recognised the necessity for protecting fibrous insulation by non-absorbent coverings, such as lead, and thereby sealing off the insulating material from contact with moisture. The absorbency of fibrous materials was due to capillarity, which meant a much greater susceptibility to moisture than would be due to other effects such as condensation, deliquescence, and so on. The capillarity of fibrous materials was due largely to the capillarity of the individual fibres themselves. The sequence of events demonstrated by the characteristic curve for cotton corresponded exactly to the cable makers' experience as to what happened during breakdowns from moisture faults. The osmotic effects merged into the formation of electrolytic products in the wall of dielectric, and incipient charring in the second part, passing to final breakdown in the third part of the curve. The fall in resistance with increase of testing voltage was simply a matter of the electrodes not making contact with the virtual conductor contained in the non-conducting mass of fibrous material.

The "valve effects" referred to by the author were well known in cable practice; it was because of these effects that factory tests on cables were always made with a negative current. In Government and other standard specifications, it was customary until a few years ago to specify that cables should be tested with both positive and negative currents, and the results compared. A difference of not more than 5 per cent. in the insulation resistance figures thus obtained rendered the cables liable to rejection. The various hysteresis effects noted by the author were probably closely connected with "valve effects." The customary method of testing the insulation resistance of cables by "loss of charge" was the only practical method. The real dielectric resistance was much greater than was indicated by the nominal grade or guaranteed figures; the steadiness of the rate of "loss of charge" gave a valuable indication as to the soundness or otherwise of a cable under test, which was quite independent of the observed value at the end of the standard one minute electrification. Porcelain could readily be obtained which was so thoroughly vitrified throughout its mass that it was non-absorbent and did not depend on its glazing for non-absorbency. He suggested that the matter of dormant water might with advantage be reconsidered on the basis of actual volumes of cellulose, air and water, both normal and added water being taken into account. He disagreed that it was customary to account for breakdown by dielectric stress; the primary cause of a breakdown was hardly ever dielectric stress *per se*, the presence of moisture was almost invariably found to be the chief contributory cause.

Mr. C. H. Wordingham said so-called "blind tests," though unscientific, were exceedingly useful. The author did not seem to make a distinction between the conduction of moisture on the surface and through the interior of porcelain, but it was important as one got a better result with a long leakage path.

Mr. B. Welbourn said a great deal of information was being obtained by present methods of cable testing, and many faults were removed from networks without the consumers knowing anything of them. He did not see how the use of flash tests could be avoided. It was a question whether the fall in potential was only due to moisture and air, as indicated in the paper, as the insulation possessed physical properties which might alter. Useful results might be obtained from some A.C. tests on the lines adopted by the author. He questioned whether the withdrawal of all the moisture from insulation was advisable in any case.

Prof. Schwartz drew attention to the peculiarities of pure rubber, which was certainly not non-absorbent. Its absorption depended partly on the character of the rubber and partly on its physical condition, and the latter underwent a considerable change within a small range of temperature. They might learn something from the work of the botanist, which showed that the water channels in plants were intersected by partitions, although they were to convey water; there were also air bubbles, and it was estimated that about half the channels were filled with air. The partitions limited the size of the bubbles, preventing them uniting and obstructing the passages. It also appeared that the smaller the pores were, the more likely water was to get in.

Mr. E. H. Rayner drew attention to the remarks in the paper concerning the speculation as to the evolution of some method which would enable the weakening of insulation of electrical plant to be detected by systematic tests, which would enable weak places to be repaired before actual failure occurred.

He said that on a laboratory scale this could now be done by superposing a continuous potential on the alternating supply used for a pressure test, and measuring the continuous current passing through the insulation by a sensitive moving-coil instrument. The results showed that with ordinary oiled cloth insulation, the increase of the continuous current as the insulation warmed under the alternating potential showed whether the insulation would stand for a long time, whether it would fail, and how quickly, with the great advantage that the application of the voltage could be stopped before permanent damage was done.

A disadvantage of the method, as at present used, was that the alternating capacity current passed through the ammeter, and was many times the rated current of the instrument. Suggestions were made as to overcoming difficulties which might be caused thereby.

Mr. Evershed briefly replied to the discussion.

Patent Restoration.—An order has been made restoring letters patent, No. 14,733 of 1905, granted to Harry Wilkins for "A New Alloy."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

UNITED STATES.—The Board of Trade, through the Foreign Office, have received a copy of an Act of the United States Congress, which provides that all articles imported from foreign countries for the purpose of exhibition, and articles and material imported solely for use in constructing, installing, and maintaining foreign buildings and exhibits at the Panama-Pacific International Exposition upon which there is a tariff or Customs duty, may be admitted free of the payment of duty, Customs fees, or charges under such regulations as the Secretary of the United States Treasury shall prescribe. It shall, however, be lawful at any time during the Exposition to sell for delivery at the discretion of the Exposition Company any goods or property imported for and actually on exhibition in the Exposition buildings or grounds on payment of the duty, if any, imposed upon them by the revenue laws in force at the date of withdrawal; and on such articles as have suffered diminution or deterioration from incidental handling and necessary exposure, the duty, if paid, shall be assessed according to the appraised value at the time of withdrawal for consumption or use.

The Act further provides for the establishment at the Exposition, not later than the 1st July, 1914, of a branch office under the direction of the United States Register of Copyrights and the Commissioner of Patents, from which the proprietor of any certificate of registration, copyright, trade-mark, or patent issued by any foreign Government protecting any pattern, model, design, copyright, trade-mark, or manufactured article, imported for exhibition and exhibited at the Exposition, may, upon presentation of satisfactory proof of such proprietorship, obtain, free of charge, a certificate which shall be legal evidence of his proprietorship. It is to be held unlawful for any person, without the authority of the proprietor thereof to copy, imitate, reproduce, or republish any pattern, model, design, trade-mark, copyright, or manufactured article, protected by the laws of any foreign country by registration, copyright, patent, or otherwise, which shall be imported for exhibition at the Exposition and there exhibited. The rights protected under the provisions of the Act are to begin on the date of the arrival of the pattern, model, design, copyrighted article, trade-mark, or manufactured article imported for exhibition within the grounds of the Exposition at San Francisco, and are to continue for a period of three years from the date of the closing of the Exposition.

S. AFRICA.—The Union Commissioner of Customs has issued to the Cape Town Chamber of Commerce further decisions as to the calculations of the value of goods on which duties are to be payable, in the following terms:—

(1) Current value for home consumption in the open market can only mean the values at the time of exportation from the country in which purchase was effected of the goods if they had been sold to be again sold in such country, such value being that at which any person without any special or exclusive favour or agreement could buy. The value that should be quoted is that of the goods if sold for home consumption in the open market at the time of exportation.

(2) Current value for home consumption at place of purchase bought in the ordinary manner from the manufacturer or supplier. The meaning assigned to (1) applies, except as regards the words "bought in the ordinary manner."

The Commissioner states that there cannot be any doubt that this means "the usual way in which a buyer deals with a manufacturer or supplier." In this connection there must be considered what is the usual practice of buying certain articles. As the current value in its relation to Customs clearly means the value at the time of exportation or importation it is obvious that contract or special agreement purchases, lasting over specified periods, are not within the meaning of the words "ordinary manner." The words, therefore, can only mean "bought outright at the time of exportation, without any special or exclusive favour or agreement."

(3) *Normal quantities.*—It must be obvious, it is stated, that this expression can only have one meaning. The obvious meaning of the word "normal" in relation to the purchase of goods to be imported into the Union is unquestionably the word "analogical." No other meaning could possibly be assigned to it. The expression, therefore, clearly means "quantities analogous, *i.e.*, similar to those being actually imported."

The Commissioner adds that the words "normal quantities" exclude the possibility of "retail prices" being the base of charge, except as regards the importation of single articles. In all cases where goods are exported from bond in the country of purchase it is obvious that the value in bond is the value in the open market. The wholesale price to dealers, applicable to the quantities exported, and as if the goods were to be sold to be consumed in the country of purchase, is obviously the value that is wanted. It is further pointed out that the law takes no cognisance of contracts, and the Commissioner states that he is not prepared to alter the practice in that respect, except that the values obtainable for the goods at the time of entering into the contract, if such goods had been

sold for consumption in the country of purchase must be stated on the invoice, and where duty is leviable, duty paid on such values. It is, however, to be clearly understood that if circumstances arise which prove that undue use is being made of the contract system, the matter will be again fully considered with the view to the Government being protected.

It is also notified that, on and after December 1st, refunds on account of full duty having been paid owing to non-production of the certificate of origin at the time of importation will not be allowed. If the preferential duty is desired, certificates must be produced when entry is made, otherwise the higher general duty will be charged.

BRAZIL.—The tax on rubber exported from the Territory of Acre will be reduced from 20 per cent. *ad valorem*, to 10 per cent. *ad valorem*, from January 1st next.

FINLAND.—The Board of Trade is informed that the quantity of samples which may be imported free of duty by commercial travellers entering Finland, is limited to such quantity as the Customs Officer at the place of importation considers necessary for commercial purposes. Any samples in excess of this quantity are dutiable at the rates fixed for the article in question in the Customs Tariff.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,946. "Means for and methods of changing the frequency of alternating electric currents." A. M. TAYLOR. November 24th.

26,948. "Apparatus for generating and storing electricity." W. J. SHEPPARD. November 24th.

26,956. "Automatic reversing controllers for electric motors." H. BAILEY. November 24th.

26,962. "Electric switch and brake combined." A. W. WATSON. November 24th.

26,978. "Magnetic or radio-magnetic hair or toilet pins, curlers, slides, or the like." W. H. HYATT. November 24th.

26,992. "Method of and means for rendering the effervescent contents of closed containers radio-active." O. A. ELIAS. November 24th. (Complete.)

26,997. "Testing-instruments for electric conductors." C. L. FARIES. November 24th. (Complete.)

27,018. "Selective electric signalling." NEW PHONOPORE TELEPHONE CO., LTD. and A. H. NICHOLSON. November 24th.

27,029. "Solenoids and electro-magnets." CLARKE, CHAPMAN & CO., LTD., and R. C. HARRIS. November 24th.

27,048. "Process for producing insulating and building materials and the like from wood pulp." B. JIROTKA. November 24th.

27,059. "Method of and apparatus for separating dust particles from gases or air by means of high-tension current." G. A. KRAUSE. November 24th. (Convention date, November 25th, 1912, Germany.) (Complete.)

27,060. "Method of separating suspended particles from gases by means of high tension electricity." G. A. KRAUSE....November 24th. (Convention date, November 25th, 1912, Germany.) (Complete.)

27,063. "Resonating relays." H. VON KRAMER and GISBERT KAPP. November 24th. (Addition to 10,856/11.)

27,098. "Automatic telephone systems." W. AITKEN. November 25th.

27,099. "Calling-devices for automatic telephone systems." W. AITKEN. November 25th.

27,114. "Spark-plugs." E. W. COLE. November 25th. (Complete.)

27,127. "Apparatus for automatically regulating electric circuits." H. LEITNER. November 25th.

27,137. "Apparatus for recording number of telephone calls." A. J. FITZGERALD and E. G. FITZGERALD. November 25th.

27,148. "Electric lighting apparatus." COLD LIGHT (Dussaud Processes), LTD. November 25th. (Soc. International de Lumière Froide (Procedes Dussaud), France). (Complete.)

27,157. "Supports for electric incandescent lamp filaments and materials for same." G. LUDECKE & BRIMSDOWN LAMP WORKS, LTD. November 25th.

27,175. "Radio-telegraph stations." W. J. MELLERSH JACKSON. November 25th. (Signal G.m.b.H. Germany.) (Complete.)

27,182. "Electric switches, fuses and the like." BRITISH THOMSON-HOUSTON CO., LTD., and E. B. WEDMORE. November 25th.

27,183. "Methods of tuning alternating-current circuits." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitats-Ges., Germany.) November 25th.

27,190. "Lighting by means of electric incandescent lamps." H. W. HANDCOCK and C. W. SMITH. November 26th.

27,198. "Ships' telegraphs." J. KOSTMANN. November 26th.

27,218. "Improvements in electric light fittings, especially applicable to fittings adapted for indirect illumination." SIMPLEX CONDUITS LTD., and L. WATERHOUSE. November 26th.

27,225. "Electric telegraphs." E. RAYMOND-BARKER. November 26th.

27,249. "Electric switches for train lighting and like installations." J. STONE & CO., LTD., and A. H. DARKER. November 26th.

27,275. "Telephone apparatus." S. COOKE and B. C. MATTHEWS. November 26th.

27,298. "Electric tram trolley-pole wheel guides." C. E. BINGLEY. November 27th.

27,321. "Non-spillable valve for portable batteries with liquid electrolyte." G. PEARSON and L. FIELDER. November 27th.

27,322. "Elastic lamp-holder, combined with reflector for miners' electric safety lamps." G. PEARSON and L. FIELDER. November 27th.

27,323. "Arrangement for positive electrode in round accumulators." G. PEARSON and L. FIELDER. November 27th.

27,329. "Production of electric impulsive discharge." R. C. GALLETTI. November 27th. (Complete.)

27,347. "Effecting the automatic interruption of the current in single electric conductors upon a short-circuit or serious leakage occurring." FELTEN and GUILLEAUME CARLSWERK AKT-GES. November 27th. (Convention date, November 27th, 1912 Germany.) (Complete.)

27,348. "Means for use in concurrently producing upon the same strip or chart records or diagrams relating to several electric currents." HARTMANN and BRAUN AKT-GES. November 27th (Convention date, January 17th, 1913, Austria.) (Complete.)

27,354. "Dynamo-electric generators." F. L. HOLLISTER. November 27th. (Divided Application on 28,748/12. December 13th.)

27,355. "Magneto-electric machines." F. L. HOLLISTER. November 27th. (Divided Application on 28,748/12. December 13th.)

27,356. "Dynamo-electric generators." F. L. HOLLISTER. November 27th. (Divided Application on 28,748/12. December 13th.)

27,357. "Electric incandescent lamps." POPE'S ELECTRIC LAMP CO., LTD. and F. R. POPE. November 27th.

27,409. "Earthenware troughs." C. E. MORRIS. November 28th.

27,426. "Electric vacuum light apparatus." MOORE LICHT AKT.-GES. November 28th. (Addition to 1,218/13, Convention date, November 28th, 1912, Germany.) (Complete.)

27,452. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT-GES. November 28th. (Convention date, November 28th, 1912, Germany.) (Complete.)

27,454. "Tramway rails." J. THON. November 28th.

27,468. "Electric arc lamps." H. J. BOOKER. November 28th.

27,472. "Electrically-driven vehicles." SIEMENS-SCHUCKERTWERKE G.M.B.H. November 28th. (Convention date, November 28th, 1912, Germany.) (Complete.)

27,473. "Ampere-meter and volt-meter for vehicles and the like." SCHOELLER & CO. November 28th. (Convention date, February 10th, 1913, Germany.) (Complete.)

27,476. "Sparking-plug for internal-combustion engines." E. RENE. November 28th.

27,477. "Controlling-devices for variable-speed dynamos." L. RENAULT. November 28th. (Convention date, December 7th, 1912, France.) (Complete.)

27,480. "Receivers for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO., LTD. and H. J. ROUND. November 28th.

27,498. "Incandescent electric lamps and the holders thereof." T. KELLY. November 29th.

27,515. "Control of electro-mechanical switches for telephone exchanges." H. BARON. November 29th. (Fritz Aldendorff, Germany.) (Complete.)

27,524. "Electric flashlight." R. PAVEY and J. PAVEY. November 29th.

27,533. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. and F. NEWFORTH, Jnr.). November 29th. (Complete.)

27,541. "Electric alarm clock." I. PILLERSDORF. November 29th. (Convention date, December 23rd, 1912, Germany.) (Complete.)

27,542. "Apparatus for use in connection with the electric lighting of automobiles." F. E. WILSON. November 29th.

27,549. "Switches for opening and closing electric circuits." H. LEITNER. November 29th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

MANUFACTURE OF ENVELOPES OF VITREOUS MATERIALS. British Thomson-Houston Co. (General Electric Co.) 18,300.

ELECTROLYTIC PRODUCTION OF METALS. R. W. Wallace and E. Wassmer. 18,449. August 10th.

PROCESS FOR THE PRODUCTION OF AMMONIA. R. W. Wallace and E. Wassmer. 18,450. August 10th.

LAMPS. M. E. M. Hagnauer and J. J. H. Crepin. 25,647. November 8th. (November 8th, 1911.)

LIGHTING APPARATUS FOR AUTOMOBILES, MOTOR-CYCLES, BICYCLES, AEROPLANES, AIR-SHIPS, BOATS, AND THE LIKE. J. De Coster. 25,861. November 11th.

INCANDESCENT ELECTRIC LAMPS. J. T. Robin. 26,186. November 14th. (Addition to 6,856/11.)

METHOD OF AND MEANS FOR CLEANING ELECTRO-PLATING AND FINISHING ARTICLES, MORE PARTICULARLY SMALL ARTICLES. G. P. M. Lee and W. A. Brame. 26,255. November 15th.

ELECTRIC SECONDARY CLOCKS. T. Rushton. 26,309. November 15th.

METHOD OF AND MEANS FOR CLEANING ELECTRO-PLATING AND FINISHING SURFACES, MORE PARTICULARLY SURFACES IN SITU. G. P. M. Lee and W. A. Brame. 26,504. November 18th.

VOLTAGE REGULATORS FOR DYNAMOS. A. P. Froger. 26,893. November 22nd. (November 23rd, 1911.)

REGULATING MECHANISM FOR ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co., E. Garton and A. H. St. C. Watson. 27,235. November 26th.

ELECTRIC INCANDESCENT LAMPS. British Thomson-Houston Co. (Allgemeine Electricitats Ges.) 27,432. November 28th.

ELECTRIC CURRENT REGULATING AND CONTROLLING APPARATUS SUCH AS ELECTRIC-MOTOR STARTING AND CONTROLLING APPARATUS AND THE LIKE. J. A. Hirst and P. S. Brook. 28,635. December 12th.

ELECTRIC MINERS' LAMP. P. Rosenberg. 28,772. December 13th.

ELECTRIC LOCKS FOR LIFT AND HOIST GATES. C. G. Major and Smith, Major and Stevens, Ltd. 29,778. December 27th.

1913.

ELECTRIC CEILING-ROSES. J. P. Smith. 534. January 8th.

SELECTING DEVICES FOR TELEPHONE OR OTHER CIRCUITS. Siemens Bros. and Co. and T. Pettigrew. 818. January 10th.

APPARATUS FOR DETECTING AND ESTIMATING CERTAIN SUBSTANCES BY VIRTUE OF THEIR POLARIZING OR DE-POLARIZING ACTION ON AN ELECTRIC COUPLE. E. K. Rideal and U. R. Evans. 1,776. January 22nd.

PRIMARY ELECTRIC BATTERIES. A. P. Manchester and H. M. Spooner. 2,693. February 1st.

IGNITION GEAR FOR INTERNAL-COMBUSTION ENGINES. W. H. Moore and Ambrose Shardlow & Co. 3,487. February 11th.

AERIAL CONDUCTORS FOR USE IN WIRELESS TELEGRAPHY. Marconi's Wireless Telegraph Co. and C. S. Franklin. 4,514. February 21st.

OZONATORS. British Thomson-Houston Co. (General Electric Co.) 4,575. February 22nd.

AUTOMATIC ELECTRICAL SWITCHES. Electric Sign Co. and W. K. L. Dickson. 4,591. February 22nd.

ELECTRIC FUSES. Appareillage Gardy (Soc. Anon.) 4,686. February 24th. (February 25th, 1912.)

SYSTEMS OF ELECTRICAL DISTRIBUTION. British Thomson-Houston Co. (General Electric Co.) 5,961. March 10th.

ELECTRIC CANDLE FITTINGS. F. Hodgson. 6,901. March 20th.

IGNITION AND PRIMING DEVICES FOR INTERNAL-COMBUSTION ENGINES AND THE LIKE. C. G. Nobbs and L. Dodson. 8,584. April 11th.

ELECTRIC SUPPLY SYSTEMS. H. D. Earl. 9,278. April 19th.

CARRYING OF METAL-SHEATHED ELECTRIC CABLES THROUGH BULKHEAD AND SIMILAR PARTITIONS. Metal Jointing Co. and T. Harden. 9,752. April 25th.